

## SPECIFICATIONS

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## SPECIFICATIONS

### DIVISION 1 - GENERAL REQUIREMENTS

#### SECTION 1.1 - GENERAL

##### 1.1.1. THE REQUIREMENT

It is required that there be constructed and completed, in accordance with the contract provisions and clauses, these specifications, and the drawings listed in paragraph 7.1.2. (List of Drawings) hereof, Pre-Engineered Carpentry/Sandblast Shop, Boulder Canyon Project, Hoover Dam, Nevada.

The work is located at the Hoover Dam Warehouse Complex, approximately 7 miles via U.S. Highway 93, northeast of Boulder City, Nevada, in Clark County, Nevada.

##### 1.1.2. DESCRIPTION OF THE WORK

Work to be performed under this solicitation consists of construction of a pre-engineered metal building.

Principal features of the work include the following:

- a. Earthwork for foundation, floor slab, and aprons.
- b. Furnishing and placing reinforced concrete foundations, floor slab, and aprons for pre-engineered metal building.
- c. Furnishing and erecting a nominal 30-foot wide by 96-foot long, clear span, insulated, pre-engineered metal building having a 16-foot eave height, and a 1:12 roof pitch. The building shall have steel man-doors and overhead vehicle doors on each end and a center divider wall.
- d. Furnishing and installing a complete electrical system.
- e. Furnishing and installing one air conditioner and one evaporative-type air cooler.
- f. Furnishing and installing one two-stage air compressor and piping.
- g. Assembling, installing, testing, and painting a Government-furnished pulse filter system.
- h. Furnishing, installing, and testing a grounding system.
- i. Furnishing and installing power cable and transformers.

### 1.1.3. STAKING OUT WORK

- a. Lines and grades.--The Contracting Officer will establish lines and grades required for proper execution of the work.

The Contractor shall give such assistance and provide such drill holes, forms, ladders, spikes, nails, and lumber as may be required by the Contracting Officer in establishing lines and grades. The Contractor shall adjust its construction operations at such points and for such reasonable time as may be necessary to assist with the work of transferring lines and marking points for line and grade.

The Government will provide only the minimum of survey crew services essential to orderly performance of the work, and Government survey crews will not be available at all times for the work under these specifications. The Contractor shall keep the Contracting Officer advised on a current basis of construction survey requirements so that survey work may be coordinated with the Contractor's sequence of operations.

- b. Replacement of survey stakes.--Where construction operations require removal of the Government's stakes or other survey marks, the Contractor shall reference such points in an approved manner. Survey stakes or marks established by the Government shall be preserved by the Contractor unless he is authorized to remove them; and in case of their destruction or removal by the Contractor's forces, they will be replaced by the Government at the Contractor's expense. The actual cost to the Government of replacing survey stakes or marks will be deducted from payments due the Contractor.

- c. Cost.--The cost of furnishing all necessary materials and performing all work required by the Contracting Officer in establishing lines and grades as described in this paragraph shall be included in the prices offered in the schedule for other items of work.

### 1.1.4. SUBMITTAL REQUIREMENTS

- a. General.--The Contractor shall furnish all materials and perform all work required for furnishing submittals to the Government, in accordance with the clause entitled "Technical Data Submittal Requirements", clause 52.236-21 entitled "Specifications and Drawings for Construction" and the clause entitled "Administration of Specifications and Drawings for Construction", this paragraph, Table 1A (List of submittals), and the requirements in the provisions, clauses, and paragraphs of this contract.

The word "submittals" shall be interpreted to include drawings, data, manuals, certifications, test reports, curves, samples, color chips or charts, brochures, and other items furnished by the Contractor for approval, informational, or other purposes.

- b. List of submittals.--Table 1A (List of submittals) lists the submittals required by this contract except those submittals which are required conditionally, required by entities other than the Bureau of Reclamation, or which are periodic in nature. Any submittal required to be submitted by the Contractor, but which is not listed in the table, shall be submitted in

accordance with the applicable requirements of this contract. In case of a conflict between the requirements of this paragraph and the requirements included elsewhere in this contract, the requirements elsewhere shall take precedence over the requirements contained in this paragraph.

c. Submittals.--Each item in table 1A (List of submittals) has been assigned an RSN (Required Submittal Number). The "Submittals required" column of the table specifies the material to be submitted for each RSN. All of the material specified for an RSN will be considered a complete set; and where the material required for an RSN is specified as separate or distinguishable parts, a complete set shall include all parts. Only complete sets shall be submitted.

The number of complete sets to be submitted, and the location to which they are to be sent, shall be in accordance with the "No. of sets to be sent to:" column of the table, except as provided below for sets of original material.

When an RSN involves submittal of original (non-copied) material, all original material, or as much thereof as is necessary to form a complete set, shall be included in just one complete set. This "originals" set shall be sent to the proper address, given in subparagraph e. below, as determined by the "Responsible code" column of the table and the following:

- (1) CO indicates Contracting Officer.
- (2) CE indicates Construction Engineer.

The "originals" set shall be counted as one of the complete sets required to be submitted under the "No. of sets to be sent to:" column of the table.

For each RSN, the Contractor shall submit complete sets of required submittal material under the cover of a transmittal letter. At the Contractor's option, complete sets for more than one RSN may be submitted under cover of the same transmittal letter, provided they have the same responsible code designation as shown in the table. The Contractor's transmittal letter shall include:

- (1) Reference to Bureau of Reclamation contract number and title.
- (2) Identification of responsible code as shown in the table.
- (3) Complete list of RSN(s) for which material is being submitted.
- (4) For each RSN, number of complete sets and list of materials included.
- (5) For each RSN, identification of the submittal as an initial submittal or a resubmittal.

Each drawing submitted by the Contractor shall have the Contractor's or supplier's title and drawing number on it. Drawings and data shall be labeled with the Bureau of Reclamation contract number and schedule item number.

Manufacturer's data for commercial products or equipment, such as catalog cut sheets, shall be clearly marked to indicate the item(s) to be furnished. The data shall be sufficiently comprehensive to identify the manufacturer's name, type, model, size, and characteristics of the product or equipment, as well as to fully demonstrate that the product or equipment meets the requirements of these specifications.

Sample and color selection submittals shall include complete manufacturer's product and color identification. Samples shall be representative of the product to be installed. A "set" of samples shall include the type and quantity of materials specified in the referenced paragraph. Color chips shall be sample paint representations; ink color reproductions will not be acceptable. Each sample, sample kit, set of color chips, or color chart shall be labeled with the Bureau of Reclamation contract number and title.

Submittals requiring certification by a registered professional shall be signed and sealed.

d. Review of submittals furnished for approval.--The time required for review of each submittal or resubmittal furnished under an RSN for approval will not begin until the Government receives complete sets of all the submittal materials required for that particular RSN. The number of calendar days required for review of drawings or data submitted or resubmitted for approval will include the date the drawings or data are received by the Government, and will extend through the date of return mailing to the Contractor.

Except as otherwise provided in the specifications for specific submittals, the Government will require 20 calendar days for review of each submittal or resubmittal furnished by the Contractor for approval, and this review time will apply to each separate submittal or resubmittal whether the submittals are approved, not approved, or returned for revision.

If the Government uses time in excess of the specified number of calendar days for review of any submittal or resubmittal, additional time, not to exceed the excess time, will be added to the time allowed the Contractor for completion of the work affected by such excess time, to the extent it is demonstrated that the excess time caused delay. If the Government's review of two or more separate submittals or resubmittals is late and results in concurrent days of excess time, such days will be counted only once in computing an extension of the completion date. Further, if the Contractor fails to make complete approval submittals in the sequence and within the time periods specified in this contract, and thus precludes the Government from approving or considering for approval such submittals within the specified calendar day period, then the Contractor shall not be entitled to an extension of time allowed for completion of the work.

Unless otherwise specified, one set of the submittals required for approval will be returned to the Contractor either approved, not approved, or conditionally approved, and will be marked to indicate changes, if required. Submittals that are not approved or that require changes or

revisions shall be revised and resubmitted for approval, and shall show changes and revisions with revision data. All requirements specified for the initial submittal shall apply to any resubmittals required. Unless otherwise specified, all submittals which are to be resubmitted shall be resubmitted by the Contractor within 20 calendar days after the Contractor has received the Government's comments.

e. Addresses.--The Contractor shall send the submittals to the applicable addresses listed below as required by Table 1A (List of submittals).

The Contractor shall also send a copy of the transmittal letter to each of the addresses listed below that are not sent the submittal.

Submittals shall be sent as required by Table 1A (List of Submittals) to:

(1) Contracting Officer, Bureau of Reclamation, P.O. Box 61470, Attention: LC-3114, Boulder City NV 89006-1470

(2) Construction Engineer, Bureau of Reclamation, P.O. Box 60400, Attention: LCD-2000, Boulder City NV 89006-0400

The cost thereof shall be included in the prices offered in the schedule for the applicable items of work requiring the submittals or other items of work.

Table 1A - List of Submittals

RSN	Item	Reference paragraph or clause	Responsible code	Submittals required	No. of sets to be mailed to:*		Due date or delivery time
					CO	CE	
C1	Bonds	52.228-15	CO	Performance and payment bonds	2	0	Within 15 calendar days after contract award.
C2	Construction schedule (1) Practicable schedule  (2) Progress chart (bar chart)	52.236-15	CE	(1) Blackline prints	1	4	Within 15 calendar days after receipt of notice of award
C3	Safety data	WBR 1452.223-900	CO	Experience Modification Rate for Worker's Compensation Insurance; Log and Summary of Occupational Injuries and Illnesses; death and lost workday severity incidence rate.	1	0	Within 20 calendar days from the date of receipt of notice of award

RSN	Item	Reference paragraph or clause	Responsible code	Submittals required	No. of sets to be mailed to:*		Due date or delivery time
					CO	CE	
C4	Insurance - Work on a Government installation	52.228-5	CO	Written proof that the required insurance has been obtained	1	0	Before commencing work under this contract.
C5	Liability insurance	DOI 1452.228-70	CO	Acceptable evidence showing that insurance has been obtained	1	0	Before commencing work under this contract
C6	Accident prevention	52.236-13	CO	Accident exposure data	1	0	As prescribed by the Contracting Officer
C7	Payment (Electronic Funds Transfer)	52.232-28	CO	Payment information	1	0	After award, but not later than 14 days prior to submission of the first invoice
C8	Release of claims	DOI 1452.204-70	CO	Release of claims (DI-137) against United States	1	0	After completion of work and prior to final payment
C9	Equal opportunity	52.222-26	CO	Information required by Executive Order 11246 (SF 100)	1	0	Within 30 days following the award
C10	Subcontracts (Labor standards data)	52.222-11	CE	(1) List of subcontractors  (2) Statement and Acknowledgment Form (SF-1413)	1	1	Within 14 days after award of contract and within 14 days after award of any subcontract
C11	Safety	WBR 1452.223-81	CE	Proposed safety program	0	4	Prior to beginning any onsite work. See section 2 of Reclamation Safety and Health Standards.
C12	Hazardous materials	52.223-3 1.4.3	CE	List of hazardous material (LHM) and Material Safety Data Sheets (MSDS)	0	2	Not less than 45 days prior to jobsite delivery
C14	Prevention of water pollution	1.5.1	CE	Certified statement regarding review and certification of the SPCC plan by a registered professional engineer	1	1	At time of such review and certification
C15	Concrete materials	3.2.1	CE	Name and manufacturer of each item to be used in concrete mix	0	3	Not less than 15 days prior to concrete placement
C16	Concrete mix	3.2.1	CE	Mix design	0	3	Not less than 15 days prior to concrete placement
C17	Pre-engineered metal building	4.1.3	CE	Brochures and data	0	2	Not more than 20 days following Notice to Proceed

RSN	Item	Reference paragraph or clause	Responsible code	Submittals required	No. of sets to be mailed to:*		Due date or delivery time
					CO	CE	
C18	Pre-engineered metal building	4.1.3	CE	a. Shop drawings b. Certification of compliance c. Foundation design and anchor bolt plan	0 1 0	4 2 4	Not more than 30 days following Notice to Proceed
C19	Pre-engineered metal building	4.1.3	CE	Final erection drawings and instructions	0	3	Not less than 20 days prior to beginning of erection
C20	Air compressor	6.1.1.	CE	Manufacturer's data	0	3	Not less than 20 days prior to purchase
C21	Rolling doors	4.1.7	CE	a. Shop drawings b. Product data c. Installation data d. Maintenance data	0	3	Not less than 30 days prior to shipment
C22	Evaporative coolers	6.3	CE	a. Approval drawings and data b. Final material	0	3	Not less than 20 days prior to purchase
C23	Propeller fans	6.4	CE	a. Approval drawings and data b. Final material	0	3	Not less than 20 days prior to purchase
C24	Packaged air-conditioning unit	6.5	CE	a. Approval drawings and data b. Final material	0	3	Not less than 20 days prior to purchase
E1	Grounding system	5.2	CE	Test report	0	3	Not less than 15 days after completion of testing
E2	Disconnect switch	5.1.6	CE	Approval drawings and data	0	3	Not less than 20 days prior to purchase
E3	Disconnect switch	5.1.6	CE	Operation and maintenance manual and bill of materials	0	3	30 Days before start of installation of equipment
E4	Load-break disconnect switch assembly	5.1.5	CE	Approval drawings and data	0	3	Not less than 20 days prior to purchase
E5	Load-break disconnect switch assembly	5.1.5	CE	Operation and maintenance manual and bill of materials	0	3	30 Days before start of installation of equipment
E6	Transformer	5.3.1	CE	Drawings and data	0	3	Not less than 20 days prior to purchase
E7	Transformer	5.3.1	CE	Test results	0	3	Not less than 15 days after completion of testing
E8	Distribution panelboard	5.1.4	CE	Drawings and data	0	3	Not less than 20 days prior to purchase

RSN	Item	Reference paragraph or clause	Responsible code	Submittals required	No. of sets to be mailed to:*		Due date or delivery time
					CO	CE	
E9	Lighting panelboard	5.1.5	CE	Drawings and data	0	3	Not less than 20 days prior to purchase
E10	Insulated conductors	5.1.2	CE	Manufacturer's data	0	3	Not less than 20 days prior to purchase
E11	Insulated conductors	5.1.2	CE	Manufacturer's data	0	3	Not less than 15 days after completion of testing
E12	Lighting systems	5.1.3	CE	Manufacturer's data	0	3	Not less than 20 days prior to purchase
P1	Paint	8.1.1	CE	Color samples	0	2	Not less than 20 days prior to application

\*CO indicates Contracting Officer, and CE indicates Construction Engineer. For mailing addresses, see subparagraph entitled "Addresses" of paragraph entitled "Submittal Requirements."

## SECTION 1.2 - MATERIALS

### 1.2.1. MATERIALS TO BE FURNISHED BY THE CONTRACTOR

- a. General.--The Contractor shall furnish all materials required for completion of the work.

The words "material" or "materials" as used in these specifications to denote items furnished by the Contractor shall be construed to mean equipment, machinery, product, component, or any other item required to be incorporated in the work.

When a separate item which includes the furnishing of any material is provided in the schedule, the cost of furnishing, hauling, storing, and handling shall be included in the price offered for that item. When a separate item is not provided in the schedule for furnishing any material required to be furnished by the Contractor, the cost of furnishing, hauling, storing, and handling shall be included in the price offered for the work for which the material is required.

Materials furnished by the Contractor shall be of the type and quality described in these specifications. The Contractor shall make diligent effort to procure the specified materials from any and all sources, but where because of Government priorities or other causes, materials required by these specifications become unavailable, substitute materials may be used: Provided, That no substitute materials shall be used without prior written approval of the Contracting Officer, said written approval to state the amount of the adjustment, if any, to be made in favor of the Government. The Contracting Officer's determination as to whether substitution shall be permitted and as to what substitute materials may be used shall be final and conclusive. If the substitute materials approved are of less value to the Government or involve less cost to the Contractor than the materials specified, an adjustment shall be made in

favor of the Government, and where the amount involved or the importance of the substitution warrants, a deductive modification to the contract will be issued. No payments in excess of prices offered in the schedule will be made because of substitution of one material for another or because of the use of one alternate material in place of another.

b. Inspection of materials.--Materials furnished by the Contractor which will become a part of the completed construction work shall be subject to inspection in accordance with clause 52.236-5 entitled "Materials and Workmanship" and clause 52.246-12 entitled "Inspection of Construction" at any one or more of the following locations, as determined by the Contracting Officer: at the place of production or manufacture, at the shipping point, or at the site of the work. To allow sufficient time to provide for inspection, the Contractor shall submit to the Contracting Officer, at the time of issuance, copies in triplicate of purchase orders, including drawings and other pertinent information, covering materials on which inspection will be made as advised by the Contracting Officer, or shall submit other evidence in the event such purchase orders are issued verbally or by letter.

The inspection of materials at any of the locations specified above or the waiving of the inspection thereof shall not be construed as being conclusive as to whether the materials and equipment conform to the contract requirements under clause 52.246-12 entitled "Inspection of Construction," nor shall the Contractor be relieved thereby of the responsibility for furnishing materials meeting the requirements of these specifications. Acceptance of all materials will be made only at the site of the work.

#### 1.2.2. MATERIALS AND WORKMANSHIP - RECLAMATION

a. Materials.--In accordance with clause 52.236-5 entitled "Material and Workmanship," all materials furnished by the Contractor shall be new and of the most suitable grade for the purpose intended considering strength, ductility, durability, and best engineering practice.

Except as specified, materials shall conform to Federal specifications or standards, or, if there are no applicable Federal specifications or standards, materials shall conform to the specifications or standards of ANSI (American National Standards Institute), ASTM (American Society for Testing and Materials), ASME (American Society of Mechanical Engineers), SAE (Society of Automotive Engineers), IEEE (Institute of Electrical and Electronic Engineers), NFPA (National Fire Protection Association), or other nationally recognized standards organization. If the Contractor proposes to deviate from, or to use materials not covered by, the aforementioned specifications and standards, the Contractor shall submit, for approval, the justification for and exact nature of the deviation, and complete specifications for the materials proposed for use.

Parts shall be made accurately to standard gauge where possible. Threads, including but not limited to those of bolts, nuts, screws, taps, pipes, and pipefittings shall be unified screw threads conforming to ANSI B1.1 or B1.20.1. For internal connections only, the Contractor will be permitted to deviate from the ANSI standards, provided the Contractor furnishes a complete set of taps and dies as might be required to facilitate repair or replacement.

All fasteners shall be permanently marked with a symbol identifying the manufacturer and with symbol(s) indicating grade, class, type, and other identifying marks in accordance with reference or applicable standards.

b. Workmanship.--The Contractor shall be responsible for the accurate manufacture and fabrication of materials in accordance with best modern practice and the requirements of these specifications, notwithstanding minor errors or omissions therein.

Liberal factors of safety and adequate shock-absorbing features shall be used throughout designs, especially for parts subjected to variable stress or shock, including alternating or vibrating stress or shock. Shock-absorbing features and parts subject to vibration shall include provisions which prevent components from loosening.

### 1.2.3. REFERENCE SPECIFICATIONS AND STANDARDS

Materials, Contractor design, construction work, and other requirements which are specified by reference to Federal Specifications, Federal Standards, or other standard specifications or codes shall be in compliance with the latest editions or revisions listed in WBR 1452.211-81, "Effective Dates of Referenced Specifications and Standards." If a more recent specification or standard is found to be in effect other than that which is listed in WBR 1452.211-81, the Contractor shall notify the Contracting Officer. In the event of conflicting requirements between a referenced specification, standard, or code and these specifications, these specifications shall govern.

Unless otherwise specified, all materials that will become a part of the completed work shall be new and shall conform to the Federal or other specifications and standards referred to herein. Where reference specifications numbers are designated throughout these specifications, they refer to Federal Specifications unless otherwise noted. In the event that the materials are not covered by Federal or other specifications, the materials furnished shall be of standard commercial quality. Where types, grades, or other options offered in the reference specifications are not specified in these specifications, the material furnished will be acceptable if it is in accordance with any one of the types, grades, or options offered.

Copies of many of the Federal Specifications and Standards may be examined at the office of the Bureau of Reclamation, Denver Office, Building 67, Denver Federal Center, West 6th Avenue and Kipling Street, Denver, Colorado. Single copies of Federal Specifications and standards may be obtained without charge from any one of the General Services Administration Business Service Centers. See provision 52.211-1 entitled "Availability of Specifications Listed in the GSA Index of Federal Specifications, Standards and Commercial Item Descriptions FPMR Part 101-29."

Bureau of Reclamation Specifications and Standards may be obtained from the Bureau of Reclamation, Attention. D-8170, PO Box 25007, Denver CO 80225. This address may also be used to order the various manuals and standard specifications printed, reprinted, or published while the Bureau of Reclamation was officially named the Water and Power Resources

Service. All references to Water and Power Resources Service or any form derivative thereof shall be considered synonymous with the Bureau of Reclamation.

Addresses for obtaining some industrial and governmental (other than Federal and Bureau of Reclamation specifications and standards) specifications, standards, and codes are listed in provision 52.211-3 entitled "Availability of Specifications Not Listed in the GSA Index of Federal Specifications, Standards and Commercial Item Descriptions."

The Contractor shall maintain onsite, a copy of all specifications, standards, codes, manuals, and other documents that are referenced in these specifications and that are pertinent to the materials being installed or work proceeding at that time. These shall be available for use by the Contracting Officer and the Contracting Officer's representatives.

In accordance with clause 52.236-5 entitled "Material and Workmanship," the references to materials, wherein manufacturer's products or brands are specified by "brand name or equal" purchase descriptions, are made as standards of comparison only as to type, design, character, or quality of the article required, and do not restrict offerors or the Contractor to the manufacturer's products or to the specific brands named. It shall be the responsibility of the Contractor to prove equality of materials and products to those referenced and to provide all descriptive information, test results, and other evidence as may be necessary to prove the equality of materials or products which the Contractor offers as being equal to those referenced.

## SECTION 1.3 - LOCAL CONDITIONS

### 1.3.1. ACCESS TO THE WORK AND HAUL ROUTES

a. General.--Rights-of-way for access to the work from existing roads will be provided by the Government "Rights-Of-Way." All work on the rights-of-way necessary for access to the site shall be performed by the Contractor.

The Contractor shall make its own investigation of the condition of available public or private roads and of clearances, restrictions, bridge-load limits, bond requirements, and other limitations that affect or may affect transportation and entry to and exit from the jobsite. Subject to clause 52.249-10 entitled "Default (Fixed-Price Construction)," the unavailability of transportation facilities or limitations thereon shall not become a basis for claims for damages or extension of time for completion of work. It shall be the Contractor's responsibility to construct and maintain, at its own expense and at its own risk, any haul roads, access roads, bridges, or drainage structures required for construction operations.

It is recommended that a visit to the site of the work be made prior to bid preparation in order to perform investigations as to the existing conditions affecting the work to be done under this contract. If the Contractor chooses not to visit the site or conduct investigations, it will nevertheless be charged with knowledge of conditions which reasonable inspection and investigations would have disclosed.

The Contractor shall assume all responsibility for deductions and conclusions as to the difficulties in performing the work.

b. Existing roads.--Existing roads are available for the Contractor's use subject to existing restrictions. The Contractor shall meet all conditions properly imposed upon the use of existing roads by those having jurisdiction there over, including (without limitation of the generality of the foregoing) seasonal or other limitations or restrictions, the payment of excess size and weight fees, and the posting of bonds conditioned upon repair of road damage caused by the Contractor.

c. Haul routes.--The hauling of sand, gravel, earth materials, or other intra job hauling, over public highways, roads, or bridges shall be in compliance with the applicable local regulations and shall be such as to minimize interference with or congestion of local traffic. Where haul routes cross public highways or roads, the Contractor shall provide barricades, flagmen, and other necessary precautions for safety of the public as provided in paragraph 1.4.1. (Safety of the Public).

d. Parking.--The Contractor shall use parking areas adjacent to the construction site as approved by the Contracting Officer, and shall not block traffic with parked vehicles, equipment, and/or materials.

e. Cost.--The cost of all work described in this paragraph shall be included in the prices offered in the schedule for other items of work.

#### 1.3.2. SECURITY AND IDENTIFICATION OF CONTRACTOR'S EMPLOYEES

The operation of Hoover Dam and Powerplant requires continuous and effective security measures. Such security is carried out by a Federal guard system, and the security regulations provide for controlled access to certain restricted areas including the switchyards, powerplant, and other critical areas. These restricted areas are designated by and may be modified or changed by the Government. The Contractor shall be responsible for initiating necessary measures to insure that its employees comply with all established security rules and regulations, including, but not restricted to, the following:

(a) Construction work areas.--All areas where work is required under this contract are designated as construction work areas. The Contracting Officer will designate suitable access ways to construction work areas for use of construction personnel. Unless specifically authorized, construction personnel shall be restricted to these areas. It shall be the Contractor's responsibility to insure, by appropriate and effective means, that its personnel remain in these areas while on the jobsite.

(b) Restricted areas.--Construction personnel shall not be permitted to enter established or designated restricted areas unless so authorized by the Contracting Officer. Such entry shall be in accordance with, and subject to, the security regulations established for the area. It shall be the Contractor's responsibility to insure, by appropriate and effective

means, that its personnel shall not enter these areas unless authorized as herein specified.

(c) Identification of Contractor employees.--Should Contractor personnel require access into secured areas, these personnel will be issued numbered identification badges clearly identifying the employee and his/her employer. Identification will include photographs. Such identification shall be required for all employees on the jobsite and badges shall be worn at all times in plain sight. Badges will be furnished by the Government.

Initial issuance of badges will be made at no cost to the Contractor; however, the cost of replacement badges shall be borne by the Contractor. All badges must be returned to the Contracting Officer upon completion of the work.

### 1.3.3. USE OF LAND FOR CONSTRUCTION PURPOSES

a. General.--The Contractor will be permitted to use Government land, controlled by the Bureau of Reclamation, for field offices, construction plants and buildings, storage yards, shops, roads, spoil areas, and other construction facilities required for construction purposes.

The storage yard available to the Contractor is located within the area that is referred to as the Hoover Dam Central Warehouse. Storage space within this yard is limited and the Contractor should expect to be sharing use of this yard with other contractors and Government employees. No enclosed storage is available and the Contractor will be responsible for protection of all materials stored at the Central Warehouse, storage yard. The ambient temperature range that might be encountered at the yard may range from 10° F. to 130° F.

If private land is used for construction facilities, or other construction purposes, the Contractor shall make all necessary arrangements and shall pay all rental and other costs associated therewith.

b. Government land.--The Contractor's use of Government land for construction purposes shall be subject to the applicable requirements of the contract clauses, Section 1.5, Environmental Quality Protection, of these specifications and to the requirements of this paragraph. Such use shall not interfere with any part of the work under this contract, nor with the work of other contractors or the Government in the vicinity, nor with reservations made, or as may be made, by the Government for use of such land.

The Contractor's construction facilities shall be arranged and operated in a manner to preserve and protect existing features, trees, and vegetation to the maximum extent practicable. The location, construction, operation, maintenance, and removal of construction facilities on Government land shall be subject to the approval of the Contracting Officer.

Housing for Contractor personnel will not be permitted on Government land, except housing for guards or watch persons as may be approved by the Contracting Officer.

Upon completion of the work, and following removal of construction facilities and required cleanup, Government land used for construction purposes and not required for the completed installation shall be regraded.

c. Cost.--No charge will be made to the Contractor for the use of Government land for construction purposes. All work required by this paragraph shall be at the expense of the Contractor.

#### 1.3.4. PROTECTION OF EXISTING INSTALLATIONS

In performing work in the existing portion of the Central Warehouse yard, the Contractor shall take all necessary precautions to safeguard existing installations which are to remain in place. The Contractor shall obtain the location of buried conduit, pipe, cable, ground mat, and other buried items prior to performing any excavations in the existing installations and shall use proper methods for their protection during excavating and backfilling operations. The Contractor shall protect adjacent installations when installing equipment and materials.

All protective installations shall be arranged in such a way to permit operation of the existing equipment and facilities by the Government while work under these specifications is in progress. The Contractor shall remove all protective installations provided by the Contractor after they have served their purpose. The materials furnished by the Contractor to provide protection shall remain the property of the Contractor.

The Contractor shall be responsible for and shall repair, at its own expense, any damage to existing installations due to the Contractor's operations or failure to provide proper protection; or at the option of the Contracting Officer, any such damage may be repaired by the Government, and the Contractor will be backcharged for the cost thereof.

The cost of all protection, as described in these specifications, including furnishing all necessary materials, shall be included in the prices offered in the schedule for other items of work.

#### 1.3.5. WATER FOR CONSTRUCTION PURPOSES

a. General.--Water from existing hydrants will be available to the Contractor for construction purposes. Such water may be used for construction purposes at no cost to the Contractor. The Contractor shall provide all means of conveying water to points of use.

The location of these facilities will be shown during pre-bid site visits or after award of the contract. Facilities are provided on an as-is, where-found basis.

b. Cost.--The cost of providing necessary facilities and conveying water to points of use shall be included in the prices offered in the schedule for other items of work.

### 1.3.6. ELECTRIC POWER FOR CONSTRUCTION PURPOSES

The Contractor shall make all necessary arrangements and shall provide all electric power required for its construction purposes. This shall include providing all necessary transmission lines, distribution circuits, transformers, and other electrical equipment required for distributing electric power to the place or places of use by the Contractor.

At the termination of the contract under these specifications, the Contractor shall dismantle and remove all distribution lines serving its installations, or those of its subcontractors, that are not part of the permanent power installation.

No direct payment will be made to the Contractor for providing electric power for construction purposes, and the cost thereof shall be included in the prices offered in the schedule for other items of work.

### 1.3.7. EXISTING FENCES

a. General.--Fences adjacent to the work may be removed by the Contractor where necessary for the performance of the work, and where required, shall be rebuilt in as good condition as found. Where designated, fences shall be maintained until the work is completed or their removal is authorized. Where the Contractor removes existing fences to facilitate the work, temporary fencing shall be provided to maintain security of the area at all times. Temporary fencing shall be removed by the Contractor as part of the cleanup operations prior to final acceptance of the completed work.

If the Contractor does not provide the necessary fences and gates to adequately secure the area within a reasonable time after need for such protection arises, the Government will cause the work to be performed and back charge the Contractor for such work.

b. The cost of all work described in this paragraph shall be included in the prices offered in the schedule for other items of work.

## SECTION 1.4 - SAFETY

### 1.4.1. SAFETY OF THE PUBLIC

Roads subject to interference by the work shall be kept open or suitable temporary passages through the work shall be provided and maintained by the Contractor. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient flasher lights, flagpersons, danger signals, and signs, and shall take all necessary precautions for the protection of the work and the safety of the public.

Roads closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning and detour signs. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise.

No construction work along public or private roads may proceed until the Contractor has proper barricades, flasher lights, flagpersons, signals, and signs in place at the construction site.

Specific signs, signals, barricades, and flagpersons requirements are detailed in sections 9 and 19 of Reclamation's publication "Reclamation Safety and Health Standards."

The cost of complying with this paragraph shall be included in the prices offered in the schedule for other items of work.

#### 1.4.2. SAFETY AND HEALTH REQUIREMENTS

a. The Contractor shall not require any laborer or mechanic employed in the performance of the contract to work under conditions which are unsanitary, hazardous, or dangerous to the laborer's or mechanic's health or safety, as determined under Construction Safety and Health Standards promulgated by the Secretary of Labor under section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327 et seq.), as amended, and "Reclamation Safety and Health Standards," published by the Bureau of Reclamation.

b. The Contractor shall fully comply with Reclamation's "Reclamation Safety and Health Standards" (RSHS) and amendments or revisions thereto in effect on the date bids are received. The RSHS manual can be ordered from: The Government Printing Office, Superintendent of Documents, North Capitol and H St. N.W., MS-SSMC - Room 566, Washington, D.C. 20401 (Stock item GPO-024-003-00178-3). Copies are available from the Contracting Officer for \$29 each at the following address:

Bureau of Reclamation  
Lower Colorado Regional Office  
Attention: LC-3114  
P.O. Box 61470  
Boulder City NV 89006-1470  
Tel: (702) 293-8653

Construction Safety and Health Standards promulgated by the Secretary of Labor may be obtained from any regional or area office of the Occupational Safety and Health Administration of the U.S. Department of Labor.

c. The Contractor shall submit in writing a proposed safety program in the form and time intervals prescribed in section 2 of the "Reclamation Safety and Health Standards."

d. The Contractor is responsible for being cognizant of and ensuring compliance with the requirements set forth in subparagraphs a. and b. above. Such responsibility shall apply to both the Contractor's operations and those of the Contractor's subcontractors. When violations of the safety and health requirements contained in these specifications or standards referenced in subparagraph a. are called to the Contractor's attention by the Contracting Officer or the Contracting Officer's authorized representatives, the Contractor shall immediately correct the condition to which attention has been directed. Such notice either oral or written,

when served on the Contractor or the Contractor's representative(s), shall be deemed sufficient.

e. In the event the Contractor fails or refuses to promptly comply with the compliance directive issued under subparagraph d. above, the Contracting Officer or the Contracting Officer's authorized representative may issue an order to stop all or any part of the work. When satisfactory corrective action is taken, an order to resume work will be issued. The Contractor shall not be entitled to any extension of time, nor to any claim for damage or to additional compensation by reason of either the directive or the stop order. Failure of the Contracting Officer or the Contracting Officer's representative to order discontinuance of any or all of the Contractor's operations shall not relieve the Contractor of the Contractor's responsibility for the safety of personnel and property.

f. The Contractor shall maintain an accurate record of, and shall report to the Contracting Officer's authorized representative in the manner prescribed by the Contracting Officer, all cases of death, occupational diseases, or traumatic injury to employees or the public involved, and property damage in excess of \$2,500 per incident to performance of work under this contract.

g. The rights and remedies of the Government provided in this paragraph are in addition to any other rights and remedies provided by law or under this contract.

h. In the event there is a conflict between the requirements contained in Reclamation's "Reclamation Safety and Health Standards," specifications paragraphs, Contractor's approved safety program, referenced safety and health codes and standards, or the U.S. Department of Labor Construction Safety and Health Standards, promulgated under section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327 et seq.), as amended, the more stringent requirement will prevail.

The cost of complying with this paragraph shall be included in the prices offered in the schedule for other items of work.

#### 1.4.3. SUBMISSION OF MATERIAL SAFETY DATA SHEETS FOR HAZARDOUS MATERIALS

After award of contract, the Contractor shall submit updated List of Hazardous Materials (LHM) and Material Safety Data Sheets (MSDS) in accordance with the requirements of paragraph (e) of the clause at FAR 52.223-3, "Hazardous Materials Identification and Safety Data."

The Contractor shall submit the updated LHM and completed MSDS and identification and certification for each material to the Bureau of Reclamation, Construction Engineer, Attention: LCD-2000, Lower Colorado Dams Facilities Office, Hoover Dam, P.O. Box 60400, Boulder City NV 89006-0400. Copies of the LHM and completed MSDS shall be submitted to the Bureau of Reclamation, Regional Safety Engineer, Attention: LC-1600, P.O. Box 61470, Boulder City NV 89006-1470. The Contractor shall not deliver any hazardous material to the

jobsite which was not included on the original LHM prior to acceptance of the Contractor's MSDS by the Construction Engineer.

The cost of complying with this paragraph shall be included in the applicable prices offered in the schedule for the items of work for which the hazardous materials are required.

## SECTION 1.5 - ENVIRONMENTAL QUALITY PROTECTION

### 1.5.1. PREVENTION OF WATER POLLUTION

a. General.--The Contractor's construction activities shall be performed by methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, or other pollutants or wastes into streams, flowing or dry watercourses, lakes, wetlands, reservoirs, or underground water sources. Such pollutants and wastes include, but are not restricted to, refuse, garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

Excavated materials or other construction materials shall not be stockpiled or deposited near or on stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff, or can in any way encroach upon the watercourse itself.

The Contractor shall also comply with the sanitation and potable water requirements of section 7 of Reclamation's "Reclamation Safety and Health Standards."

b. Laws, regulations, and permits. --The Contractor shall comply with applicable Federal and State laws, orders, regulations, and water-quality standards concerning the control and abatement of water pollution and in the event there is a conflict between State and Federal laws, regulations, and requirements, the most stringent shall apply. Consistent violations of applicable Federal or State laws, orders, regulations, or water-quality standards shall result in the Contracting Officer stopping all site activity until compliance is assured. The Contractor shall not be entitled to any extension of time, claim for damage, or additional compensation by reason of such a work stoppage. Corrective measures required to bring activities into compliance shall be at the Contractor's expense.

c. Cost.--Except as specified above, the cost of complying with this paragraph shall be included in the prices offered in the schedule for other items of work.

### 1.5.2. ABATEMENT OF AIR POLLUTION

a. General.--The Contractor shall comply with applicable Federal, State, and local laws and regulations, and with the requirements of this paragraph concerning the prevention and control of air pollution. Should a conflict exist in the requirements for abatement of air pollution, the most stringent requirement shall apply. The Contractor shall utilize such methods and devices

as are reasonably available to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants.

Equipment and vehicles that show excessive emissions of exhaust gases shall not be operated until corrective repairs or adjustments reduce such emissions to acceptable levels.

Abatement of dust pollution shall be in accordance with the applicable requirements of Reclamation's "Reclamation Safety and Health Standards," and paragraph 1.5.3. (Dust Abatement).

b. Cost.--The cost of complying with this paragraph shall be included in the prices offered in the schedule for other items of work.

#### 1.5.3. DUST ABATEMENT

a. General.--During performance of work required by these specifications, or any operations appurtenant thereto, and whether on rights-of-way provided by the Government or elsewhere, the Contractor shall comply with applicable Federal, State, and local laws and regulations, with applicable requirements of Reclamation's "Reclamation Safety and Health Standards," and with the requirements of this paragraph regarding prevention, control, and abatement of dust pollution. Should a conflict exist in the requirements for dust abatement, the most stringent requirement shall apply. The Contractor shall be responsible for all damages resulting from dust originating from Contractor operations under these specifications in accordance with clause 52.236-7 entitled "Permits and Responsibilities."

The Contractor shall provide all labor, equipment, and materials, and shall use efficient methods wherever and whenever required to prevent dust nuisance or damage to persons, property, or activities, including, but not limited to, dwellings and residences, recreational activities, traffic, and similar conditions.

The Contracting Officer has the authority to stop any construction activity contributing to dust levels which are excessive or in violation of Federal, State, or local laws. All costs resulting from such a work stoppage shall be the responsibility of the Contractor.

b. Cost.--The cost of complying with this paragraph shall be included in the prices offered in the schedule for other items of work.

#### 1.5.4. NOISE ABATEMENT

a. General.--The Contractor shall comply with applicable Federal, State, and local laws and regulations, with applicable requirements of Reclamation's "Reclamation Safety and Health Standards," and with the requirements of this paragraph regarding the prevention, control, and abatement of harmful noise levels. Should a conflict exist in the requirements for noise abatement, the most stringent requirement shall apply.

- b. Cost.--The cost of complying with this paragraph shall be included in the prices offered in the schedule for other items of work.

#### 1.5.5. PESTICIDES

- a. General.--Pesticides include herbicides, insecticides, fungicides, rodenticide, piscicide, avicides, surface disinfectants, animal repellents, and insect repellents.

With the exception of insect repellents to be applied directly to clothing or skin and small quantities of aerosol insecticides, such as fly and spider sprays, to be applied within or directly to offices or shop buildings, the use of pesticides will not be allowed under this contract.

Pesticides, including insect repellents and aerosol insecticides, shall be considered harmful chemicals, and the applicable requirements of Reclamation's "Reclamation Safety and Health Standards" shall apply to the storage and application of pesticides. Should a conflict exist in the requirements for dealing with pesticides, the most stringent requirement shall apply.

- b. Cost.--The cost of complying with this paragraph shall be included in the prices offered in the schedule for other items of work.

#### 1.5.6. CLEANUP AND DISPOSAL OF WASTE MATERIALS

- a. General.--The Contractor shall be responsible for the cleanup and disposal of waste materials and rubbish. The disposal of waste materials and rubbish shall be in accordance with applicable Federal, State, and local laws and regulations, with applicable requirements of Reclamation's "Reclamation Safety and Health Standards," and with the requirements of this paragraph. Should a conflict exist in the requirements for cleanup and disposal of waste materials, the most stringent requirement shall apply.

The Contractor shall keep records of the types and amounts of waste materials produced and of the disposal of all waste materials on or off the jobsite.

In the event of the Contractor's failure to perform the work required by this paragraph, the work may be performed by the Government, and the Contractor will be back charged for the cost of such work. The Contractor's surety or sureties shall be liable for such payment until received by the Government.

- b. Cleanup.--In accordance with clause 52.236-12 entitled "Cleaning Up," the Contractor shall keep work and storage areas free from accumulations of waste materials and rubbish, and before completing the work, shall remove all plant facilities, buildings, including concrete footings and slabs, rubbish, unused materials, concrete forms, and other like materials, which are not a part of the permanent work.

Upon completion of the work, and following removal of construction facilities and required cleanup, work areas shall be regraded and left in a neat manner conforming to the natural appearance of the landscape.

c. Disposal of hazardous waste and materials.--Hazardous waste, as defined by 40 CFR 261.3; and hazardous materials, as defined by Federal Standard No. 313, as amended; or other Federal, State, or local laws or regulations, used by the Contractor or discovered in work or storage areas, shall be disposed of in accordance with these specifications and applicable Federal, State, and local laws and regulations. Waste materials that may be hazardous shall be tested, and the test results shall be submitted to the Contracting Officer for review.

Waste materials known or found to be hazardous shall be disposed of in approved treatment or disposal facilities. Hazardous wastes shall be recycled whenever possible. A copy of the hazardous waste manifest shall be sent to the Contracting Officer.

Waste materials discovered at the construction site shall immediately be reported to the Contracting Officer. If the waste may be hazardous, the Contracting Officer may order delays in the time of performance or changes in the work, or both. If such delays or changes are ordered, an equitable adjustment will be made in the contract in accordance with the applicable clauses of the contract.

d. Disposal of other waste materials.--

(1) General.--Waste materials including, but not restricted to, refuse, garbage, sanitary wastes, industrial wastes, and oil and other petroleum products, shall be disposed of by the Contractor.

(2) Disposal by removal.--Waste materials to be disposed of by removal from the construction area shall be removed prior to completion of the work under these specifications. All materials removed shall become the property of the Contractor.

Where waste materials are to be dumped, they shall be dumped only at an approved dump. The Contractor shall make any necessary arrangements with private parties and county officials pertinent to locations and regulations of such dumping, and shall pay any fees or charges required for such dumping.

e. Cost.--Except as provided above, the cost of cleanup and disposal of waste materials in accordance with this paragraph shall be included in the prices offered in the schedule for other items of work.

## SECTION 1.6 - SITEWORK

### 1.6.1 REMOVING EXISTING BITUMINOUS SURFACING

a. General.--The Contractor shall remove existing bituminous surfacing where required for construction of the pre-engineered metal building, drive slabs, stoops, equipment foundations, and trenches. Existing bituminous surfacing shall be saw-cut to form a vertical joint between new and existing bituminous surfacing. Where existing bituminous surfacing has been removed and is to be replaced, the ground surfaces shall be prepared in accordance with the provisions of Paragraph 2.3.1 (Preparation of Subgrade).

b. Disposal.--The Contractor shall dispose of waste materials by removing materials from the construction area. All materials removed shall be disposed of in accordance with the provisions of Paragraph 1.5.6.(Cleanup and Disposal of Waste Materials).

c. Cost.--The cost for removing existing bituminous surfacing shall be included in the lump sum price offered in the schedule for furnishing and erecting the pre-engineered metal building.

## 1.6.2 PLANT-MIX BITUMINOUS SURFACING

a. General.--The Contractor shall furnish and place bituminous pavement for resurfacing around the pre-engineered metal building and over the water line and conduit excavations and any other areas where the existing bituminous surfacing has been disturbed. The completed plantmix bituminous pavement course shall be acceptable to the Contracting Officer in both composition and construction quality.

A tack coat of emulsified asphalt shall be furnished and applied to faces of concrete or existing pavement against which new bituminous pavement is to be placed.

A prime coat of liquid asphalt shall be furnished and applied to the surface of the aggregate base course prior to placing bituminous pavement on the base layer.

All reference to NDOT standard specifications in this section shall mean the Nevada Department of Transportation "Standard Specifications for Road and Bridge Construction," 1986 edition and any later supplements thereto.

All reference to AASHTO standard specifications in this section shall mean American Association of State Highway and Transportation Officials, " Standard Specifications for Transportation Materials and Methods of Sampling and Testing, 18 Edition," Year Published 1997 and any later supplements thereto.

b. Mix design.-- Hot plant-mix bituminous pavement mixtures conforming to Nevada Department of Transportation mix design criteria and material requirements may be obtained from commercial suppliers as approved by the Contracting Officer. Unless otherwise specified in this paragraph or otherwise approved by the Contracting Officer, the bituminous pavement construction shall conform to conventional construction practices as commonly specified in the applicable provisions of section 401 of the Nevada standard specifications.

c. Materials --

(1) Mineral aggregate.--Mineral aggregate for plant-mix bituminous pavement course shall conform to the required grading limits and test requirements set forth for type 4 material for surface course in section 705 of the Nevada standard specifications.

(2) Mineral filler.--Commercial mineral filler shall conform to the requirements of AASHTO designation: M 17.

- (3) Asphalt cement.--Asphalt cement, grade AR-8000 for the surface course, conforming to the requirements of subsection 703.03.02 of the Nevada standard specifications shall be used in the mix unless otherwise approved by the Contracting Officer.
- (4) Emulsified asphalt.--Emulsified asphalt, grade SS-1, conforming to the requirements of subsection 703.03.04 of the Nevada standard specifications shall be used where a tack coat is required to be applied.
- (5) Liquid asphalt.--Liquid asphalt, grade MC-250, conforming to the requirements of subsection 703.03.03 of the Nevada standard specifications shall be used where a prime coat is required to be applied.

d. Construction.--Quality control shall be the responsibility of the Contractor. The construction requirements for plant operation, mixing, placing, finishing, compacting, and smoothing, including longitudinal joint construction and surface tolerances, for placement of the bituminous surface course shall be as specified in the applicable construction paragraphs of sections 303, 401, and 402 of the Nevada standard specifications.

Surfaces required to be given a tack coat shall be thoroughly cleaned prior to application of tack coat material. The emulsified asphalt tack coat shall be applied at a rate of approximately 0.08 gallon of diluted material per square yard and at a temperature between 75 and 130 °F. The emulsion shall be properly diluted with water and applied as specified in section 405 of the Nevada standard specifications.

The liquid asphalt prime coat shall be applied to the full width of the area of aggregate base course to be surfaced at a rate of approximately 0.25 gallon per square yard and at a temperature between 165 and 220 °F. The prime coat shall be allowed to dry prior to placing bituminous surfacing. The prime coat shall not be applied during rainy weather or when the atmospheric temperature is less than 50 °F.

e. Cost.--The cost for furnishing and placing bituminous surfacing shall be included in the lump sum price offered in the schedule for furnishing and erecting the pre-engineered metal building.

## DIVISION 2--EARTHWORK

## SECTION 2.1 - EARTHWORK, GENERAL

## 2.1.1. COMPACTING EARTH MATERIALS

a. General.--Where compacting of earth materials is required, the materials shall be deposited in horizontal layers and compacted as specified in this paragraph. The excavation, placing, moistening, and compacting operations shall be such that the material will be uniformly compacted and will be homogeneous, free from lenses, pockets, streaks, voids, laminations, or other imperfections.

b. Compacting cohesionless materials:

(1) Compacting cohesionless free-draining materials.--Where compaction of cohesionless free-draining materials, such as sands and gravels, is required, the materials shall be deposited in horizontal layers and compacted to the relative density specified below. The excavating and placing operations shall be such that the materials, when compacted, will be blended sufficiently to secure the highest practicable unit weight and best stability. Water shall be added to the materials as may be required to obtain the specified density by method of compaction being used.

The thickness of the horizontal layers after compaction shall not be more than six (6) inches if compaction is performed by tampers or rollers; not more than twelve (12) inches if compaction is performed by treads of crawler-type tractor, surface vibrators, or similar equipment; and not more than the penetrating depth of the vibrator if compaction is performed by internal vibrators.

The relative density of the compacted materials shall be not less than seventy (70) percent as determined by the Bureau of Reclamation "Determination of Percent Relative Density" procedure (designation USBR 7250) of the "Earth Manual, Part 2, Third Edition."

(a) Relative density test.--The relative density of a cohesionless free-draining soil is defined as its state of compactness with respect to the loosest and most compact states at which it can be placed by laboratory procedures described in designation USBR 7250 of the "Earth Manual, Part 2, Third Edition." The relative density is determined by the following formula, wherein the maximum density is the highest density of the soil, minimum density is the lowest density of the soil, and in-place density is the density of the minus 3-inch fraction or portion of the soil in place. Tests for moisture content are made on the materials and the unit weights are expressed in terms of oven-dry weights.

$$\text{Rel. Den. (\%)} = \frac{\text{max.den.} \times (\text{in-place den.} - \text{min.den.})}{\text{in-place den.} \times (\text{max.den.} - \text{min.den.})} \times 100$$

(2) Compacting cohesionless materials containing some clay and silt.--Cohesionless materials containing clay and silt may not be free draining. When compaction of cohesionless materials containing clay and silt is required, the materials shall be compacted to a dry density in accordance with either subparagraph (a) or (b) below, using whichever test that results in the higher dry unit weight of the compacted material in the placement.

(a) Dry density using the Bureau of Reclamation laboratory compaction test as prescribed in subparagraph b(1) above.--Prior to and during compaction operations, the materials shall have a moisture content of not greater than two (2) percentage points wet or not less than four (4) percentage points dry of optimum moisture, as determined by the Contracting Officer, and the moisture content shall be uniform throughout each layer: Provided, That for materials being compacted that have a moisture content of not greater than two (2) percentage points wet or not less than two (2) percentage points dry of optimum moisture, the dry density of the soil fraction in the compacted material shall not be less than 95 percent of the laboratory maximum soil dry density, as determined by the Bureau of Reclamation laboratory compaction test; and that for materials being compacted that have a moisture content between 2 and 4 percentage points dry of optimum moisture, the dry density of the soil fraction in the compacted material shall not be less than 98 percent of the laboratory maximum soil dry density, as determined by the Bureau of Reclamation laboratory compaction test.

(b) Dry density using the relative density test as prescribed in subparagraph b.(1)(a) above.--The relative density of the compacted material shall be not less than seventy (70) percent as determined by the Bureau of Reclamation "Determination of Percent Relative Density" procedure (designation USBR 7250 of the "Earth Manual, Part 2, Third Edition").

Except as otherwise provided for moisture content in subparagraph b.(2)(a) above, the materials shall be moistened, placed, and compacted in accordance with subparagraph b. above when density is determined by the Bureau of Reclamation laboratory compaction test. When density is determined by the relative density test, the materials shall be moistened, placed, and compacted in accordance with subparagraph b.(1) above.

c. In-place densities.--The in-place density of the compacted material in trenches will be determined by one of the following: (1) Field Density Test Procedures, designation (USBR 7205), Bureau of Reclamation "Earth Manual, Part 2, Third Edition"; (2) the sleeve method (ASTM D 4564); or (3) other tests or methods designated by the Construction Engineer. The data for compacted material testing procedures are available from the Construction Engineer.

d. Costs.--The cost of compacting earth materials as described in this paragraph, including furnishing water and moistening the materials, shall be included in the prices offered in the schedule for items of the work where earth materials are required to be compacted under these specifications.

## SECTION 2.2 - EXCAVATION

### 2.2.1. EXCAVATION, GENERAL

a. General. -- Excavation for the reinforced concrete footings, foundation, floor slab and aprons for the pre-engineered carpentry/sandblast building and other excavations shall be performed in accordance with this paragraph. Excavation shall be performed to the lines and grades shown on the drawings or prescribed by the Contracting Officer.

Blasting for excavation will not be permitted.

All necessary precautions shall be taken to preserve the material below and beyond the established lines of all excavation in the soundest possible condition. Any damage to the work due to the Contractor's operations shall be repaired at the expense of and by the Contractor. Material beyond the prescribed excavation lines which is loosened by the Contractor's operations shall be removed or compacted at the expense of the Contractor.

If at any point in excavation, material is excavated beyond the established excavation lines, the overexcavation shall be filled with aggregate base materials approved by the Contracting Officer and compacted in accordance with Paragraph 2.1.1. (Compacting Earth Materials); or if at any point in such excavation the foundation material is disturbed or loosened during the excavation process or otherwise, it shall be removed and replaced with aggregate base materials approved by the Contracting Officer and the aggregate base materials shall be compacted in accordance with Paragraph 2.1.1. (Compacting Earth Materials).

b. Classification of excavation.--Materials excavated will not be classified for payment.

c. Excavated materials.--The Contractor's operations in excavations shall be such that the excavations will yield as much suitable material for use in the permanent construction required under these specifications as practicable, and the Contractor's operations and the suitability of material shall be subject to the approval of the Contracting Officer. Where practicable, as determined by the Contracting Officer, suitable materials shall be excavated separately from the materials to be wasted. The materials shall be placed in the designated final locations directly from the excavation, or shall be placed in temporary stockpiles and later placed in the designated locations as directed by the Contracting Officer.

Excavated materials which are unsuitable for backfill, or other earthwork requirements, as determined by the Contracting Officer, shall be wasted as provided in Paragraph 2.2.2. (Disposal of Excavated Materials).

d. Surfaces of excavation.--The surfaces of excavation, upon or against which concrete is to be placed shall be finished to the dimensions shown on the drawings or prescribed by the Contracting Officer, and the surfaces as prepared shall be moistened with water and tamped or rolled with suitable tools or equipment to form compact foundations upon or against which to place the concrete structures.

### 2.2.2. DISPOSAL OF EXCAVATED MATERIALS

- a. General.--So far as practicable, as determined by the Contracting Officer, all suitable materials from excavation required under these specifications shall be used as backfill.

Excavated materials that are unsuitable or in excess of permanent construction requirements, shall be wasted. The disposal of all excavated materials that are to be wasted shall be subject to the approval of the Contracting Officer. The Contractor shall haul unsuitable backfill material and excavated paving material to an area approved by the Contracting Officer and as described in Paragraph 1.5.6. (Cleanup and Disposal of Waste Materials).

- b. Cost.--The cost of all work described in this paragraph shall be included in the price offered in the schedule for excavation.

### 2.2.3. MEASUREMENT AND PAYMENT

Measurement, for payment, for excavation will be made on the basis of the dimensions shown on the drawings or where dimensions are not shown on the drawings the basis shall be as prescribed by the Contracting Officer.

Payment for excavation will be made at the unit price per cubic yard bid therefore in the schedule. The price offered in the schedule shall include the cost of all materials and labor required for excavation.

## SECTION 2.3 - AGGREGATE BASE COURSE

### 2.3.1. PREPARATION OF SUBGRADE

- a. General.--Before aggregate base material is placed, the subgrade shall be graded to conform to prescribed grades and cross sections and shall be compacted so that aggregate base material, when placed, will not mix with the subgrade material. Where directed, water shall be added to the subgrade before compacting.

- b. Cost.--The cost of performing all work incidental to preparing the subgrade, including grading, compacting and watering, shall be included in the price offered in the schedule for placing and compacting aggregate base.

### 2.3.2. AGGREGATE BASE

- a. General.--The Contractor shall place aggregate base where shown on the drawings or as directed. Mineral aggregate for aggregate base, water, and soil binder, if required, shall be furnished by the Contractor.

- b. Materials.--Mineral aggregate for aggregate base shall consist of broken stone, crushed gravel, gravel, or a combination thereof, and shall be uniform in quality and grading. The aggregate shall be free from adobe, vegetable matter, loam, and other deleterious substances

and shall be of such quality that it will compact thoroughly when watered and rolled to form a firm well-bonded base. When tests indicate the material is deficient in binder, additional soil binder shall be added to the material but only in such amounts as will insure the total material conforming to the following requirements. Soil binder shall be pulverized before mixing with rock, gravel, or stone aggregate.

- (1) Grading.--The aggregate when tested by means of standard screens (designation 4) shall conform to the following limits of gradation:

100 percent passing a screen with 1-inch-square openings;

90 to 100 percent passing a screen with 3/4-inch-square openings;

35 to 65 percent passing a No. 4-mesh screen;

15 to 40 percent passing a No. 16-mesh screen; and

2 to 10 percent passing a No. 200-mesh screen.

- (2) Quality.--When subjected to the Los Angeles abrasion test (designation 21), the aggregate shall have a loss, using grading A, not to exceed 50 percent, by weight, at 500 revolutions. The designations in parentheses refer to methods of test described in the Eighth Edition of the Bureau of Reclamation Concrete Manual. The Government will test the aggregate, and the Contractor shall provide such facilities as may be necessary for procuring representative test samples (designation 1).

Commercially available aggregate base course material conforming to the requirements set forth in section 704 of the Nevada standard specifications for type II, class B aggregate base shall be acceptable for use as required by this paragraph.

c. Placing. -- Preparation of the subgrade for aggregate base shall conform to Paragraph 2.3.1. (Preparation of Subgrade). The aggregate base, when thoroughly compacted, shall conform to the grades and dimensions shown on the drawings or otherwise established. Depositing and spreading the materials shall be accomplished by any practical means which obtains the specified results. Before the material has been spread, it shall be mixed thoroughly, until the material shows a uniform mixture of all sizes of particles. Wetting may be necessary to obtain proper mixing.

d. Compacting.--The material shall be rolled or tamped until it is compacted thoroughly and is true to grade and cross section. Sufficient water to obtain compaction shall be applied during the compaction operations. The aggregate base shall be compacted to a relative density of not less than 95 percent as determined by tests as described in paragraph 2.1.1. (Compacting Earth Materials).

### 2.3.3 MEASUREMENT AND PAYMENT

Measurement, for payment, for furnishing and placing aggregate base course will be made on the basis of the dimensions shown on the drawings or where dimensions are not shown on the drawings the basis shall be as prescribed by the Contracting Officer.

Payment for furnishing and placing aggregate base course will be made at the unit price per cubic yard offered therefore in the schedule. The price offered in the schedule shall include the cost of all materials and labor required for the aggregate base course including furnishing, placing, and compacting the material.

## DIVISION 3--CONCRETE

## SECTION 3.1 - CONCRETE CONSTRUCTION, GENERAL

## 3.1.1. CONCRETE CONSTRUCTION, GENERAL

The Contractor shall construct the reinforced concrete floor slab, equipment foundations and approaches as shown on the drawings.

The concrete compressive strength at 28 days shall be 4,000 psi.

The Contractor shall furnish all materials for use in concrete, including cementitious materials, water, sand, coarse aggregate, and specified admixtures; and shall furnish all reinforcing bars and fabric and materials for curing concrete.

## SECTION 3.2 - GENERAL CONCRETE REQUIREMENTS

## 3.2.1. SUBMITTALS

Submittals shall be in accordance with this paragraph and paragraphs 3.2.7. (Repair of Concrete) and 1.1.4. (Submittal Requirements).

a. Approval data.--Not less than 15 days prior to placement of concrete, the Contractor shall submit to the Government the name and manufacturer of each cementitious material, admixture, curing compound, aggregate source, and floor hardener. The Government reserves the right to require submission of manufacturer's test data and certification of compliance with specifications, and to require submission of samples of all concrete materials for testing prior to or during use in concrete.

b. Mix design.--The Contractor shall submit each concrete mix design for approval not less than 15 days prior to the use of the concrete mix.

## 3.2.2. MATERIALS

a. Cement.--Portland cement shall meet the requirements of ASTM designation: C 150 for type II or type V portland cement and shall meet the low-alkali and false-set limitations specified therein. The low-alkali limitation for cement may be waived on request if the sand and coarse aggregate do not contain objectionable quantities, as determined by the Contracting Officer, of potentially alkali-reactive particles defined by mortar bar tests and complete petrographic analyses of the proposed aggregate. If the Contractor requests waiver of the low-alkali limitation, he will be required to submit petrographic analyses satisfactory to the Contracting Officer unless such analyses have been performed by the Bureau of Reclamation. The cement shall be free from lumps and contamination by water and other foreign matter when used in concrete.

b. Water.--Water shall be free from objectionable quantities of silt, organic matter, salts, and other impurities.

c. Sand and coarse aggregate.--Sand and coarse aggregate shall consist of clean, hard, dense, durable, uncoated rock fragments that are free from injurious amounts of dirt, organic matter, and other deleterious substances. Sand and coarse aggregate shall meet all requirements of ASTM designation; C 33. Coarse aggregate shall conform to ASTM designation: C 33 gradings for either size No. 467 (1-1/2-inch to No. 4 United States Standard sieve) or size No. 57 (1 inch to No. 4).

The Government reserves the right to test the sand and coarse aggregate and, if required, the Contractor shall submit for preliminary tests and approval representative samples of the sand and coarse aggregate proposed for use in the concrete work.

d. Air-entraining admixture.--The air-entraining admixture shall conform to ASTM designation: C 260: Provided, that air-entraining admixture used with type F or G chemical admixture shall be a neutralized vinsol resin formulation.

e. Chemical admixture.---The Contractor may use chemical admixtures which conform to ASTM designation: C 494, type A or D.

f. Reinforcing bars and fabric. - Reinforcing bars shall be deformed reinforcement bars conforming to ASTM A 615 or A 617, grade 40 or 60. Fabric shall be electrically welded-wire fabric conforming to ASTM A 185 or A 497.

g. Curing compound--Wax-base (type I) and water-emulsified, resin-base (type II) curing compound shall conform to the requirements of Water and Power Resources Service "Specifications for Concrete Curing Compound," dated October 1, 1980. Curing compound shall be of uniform consistency and quality within each container and from shipment to shipment.

The concrete shall be cured and protected in accordance with Paragraph 3.2.5. (Concrete Placement, Curing, and Protection).

h. Polyethylene film.--Polyethylene film for curing concrete shall be white in color, shall be 4 mils thick, and shall conform to the requirements of ASTM designation: C 171.

### 3.2.3. COMPOSITION

Unless otherwise directed, the Contractor shall design the concrete mix in accordance with these specifications. Mix designs shall provide for the minimum cementitious materials contents listed in table 3A (Minimum cementitious materials content).

Table 3A. - Minimum cementitious materials content

Nominal maximum size aggregate in concrete	Minimum cementitious materials content without water-reducing admixture	Minimum cementitious materials content with water-reducing admixture
1-1/2 inches	565 lb/yd <sup>3</sup>	535 lb/yd <sup>3</sup>
1 inch	620 lb/yd <sup>3</sup>	585 lb/yd <sup>3</sup>
3/4 inch	658 lb/yd <sup>3</sup>	625 lb/yd <sup>3</sup>

Each mix design shall be submitted to the Contracting Officer for review prior to use of the concrete mix. See subparagraph 3.2.1. (Submittals).

The Contracting Officer will test concrete for compliance with specifications and reserves the right to design and adjust the concrete mix proportions.

Air-entraining admixture shall be used in such an amount as will effect the entrainment of from 4 to 6 percent air, by volume, of the concrete as discharged at the placement.

The slump of the concrete shall not exceed 3 inches plus or minus 1 inch when placed, nor 5 inches when first mixed, unless a type 1 or 2 plasticizing chemical admixture is used to produce flowing concrete for an unusual placing condition. Then the slump shall be appropriate for the placing conditions.

Chemical admixtures which conform to ASTM C 494 for type C or E, including calcium chloride, shall not be used in concrete.

#### 3.2.4. BATCHING, MIXING, AND TRANSPORTING

Concrete shall be manufactured and delivered in accordance with ASTM C 94, "Standard Specifications for Ready Mixed Concrete."

When bulk cementitious materials and aggregates are dry batched and hauled to where mixing is accomplished, each batch shall be protected during transit to prevent loss and to limit prehydration of the cementitious materials. Separate compartments with suitable covers shall be provided to protect the cementitious materials, or they shall be completely enfolded in and covered by the aggregates to prevent wind loss. If cementitious materials are enfolded in moist aggregates or otherwise exposed to moisture and delays occur between batching and mixing, the Contractor shall, at the Contractor's own expense, add extra cementitious materials to each batch in accordance with the schedule in table 3B (Additional cementitious materials requirements).

Table 3B. - Additional cementitious materials requirements

Hours of contact between cementitious materials and wet aggregate	Additional cementitious materials required
0 to 2	0 percent
2 to 3	5 percent
3 to 4	10 percent
4 to 5	15 percent
5 to 6	20 percent
Over 6	Batch will be rejected

The Government reserves the right to require the addition of cementitious materials for shorter periods of contact during periods of hot weather, and the Contractor shall be entitled to no additional compensation by reason of the shortened period of contact.

When delivered at the jobsite, each batch of concrete shall be accompanied by a batch ticket in accordance with ASTM C 94. The batch ticket shall be delivered to the Contracting Officer's representative at the jobsite as each batch is delivered.

### 3.2.5. CONCRETE PLACEMENT, CURING, AND PROTECTION

Steel reinforcing bars and fabric shall be placed as shown on the drawings. Before reinforcement is placed, the reinforcement shall be cleaned of heavy, flaky rust; loose mill scale; dirt; grease; or other foreign substances. Reinforcement shall be accurately placed and secured in position so that it will not be displaced during the placing of concrete.

Forms shall be used to shape the concrete to the required lines. Exposed unformed surfaces shall be brought to uniform surfaces and given a reasonably smooth, wood-float or steel-trowel finish as directed.

The temperature of the concrete when it is being placed shall be not more than 90° F and not less than 50° F.

The concrete shall be cured with water, curing compound, or polyethylene sheets. If water cured, the concrete shall be kept continuously moist for at least 14 days after being placed by sprinkling or spraying, or by other methods approved by the Contracting Officer. Curing compound, when used, shall be applied in accordance with the procedures contained in the Eighth Edition - 1981 Revised Reprint of the Bureau of Reclamation "Concrete Manual." Concrete cured by covering with polyethylene sheeting shall be kept continuously moist for at least 14 days after placement.

The Contractor shall protect all concrete against injury until final acceptance by the Government. The concrete shall be maintained at a temperature not lower than 50° F for at least 72 hours after it is placed and, if water cured, shall be protected against freezing

temperatures for the duration of the curing period. Then after discontinuance of the water curing, this concrete shall be maintained above freezing for the next 72 hours. Where artificial heat is employed, special care shall be taken to vent the heater and to keep the concrete from drying.

### 3.2.6. FINISHES AND FINISHING

a. General.--The requirements for finishing of concrete surfaces shall be as specified in this paragraph, or as directed by the Contracting Officer. The Contractor shall notify the Contracting Officer before placing concrete that requires a finished surface. Unless inspection is waived in each specific case, finishing of concrete shall be performed only when a Government inspector is present.

Deviations from specified lines, grades, and dimensions shall not exceed 1/2-inch. The maximum allowable concrete surface irregularity as determined by measuring the gap between a straightedge and the concrete surface is 1/8-inch.

b. Formed surfaces.--Formed surfaces of concrete will not require finishing unless the formed surface will be exposed to public view.

c. Unformed surfaces.--The Contractor shall finish the unformed concrete surface by using a floated finish unless directed by the Contracting Officer.

Floating may be performed by use of hand or power driven equipment. Floating shall be started as soon as the screeded surface has stiffened sufficiently and shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. The floor slab shall be given a smooth finish and the approaches shall be given a broom finish.

d. Cost.--The cost of furnishing all materials and performing all work necessary for finishing concrete as specified herein shall be included in the price offered in the schedule for furnishing and placing reinforced concrete.

### 3.2.7. REPAIR OF CONCRETE

a. General.--Concrete shall be repaired in accordance with this paragraph and Bureau of Reclamation "Standard Specifications for Repair of Concrete," dated March 1, 1990.

b. Submittals.--Submittals shall be in accordance with paragraph 1.1.4. (Submittal Requirements) and the "Standard Specifications for Repair of Concrete."

c. Method of repair or replacement.--The method of repair or replacement shall be as determined and directed by the Contracting Officer and in accordance with the "Standard Specifications for Repair of Concrete."

d. Cost.--The cost of furnishing all materials and performing all work required in the repair of concrete shall be borne by the Contractor.

### 3.2.8. MEASUREMENT AND PAYMENT

Measurement, for payment, for furnishing and placing reinforced concrete will be made on the basis of the dimensions shown on the drawings or where dimensions are not shown on the drawings the basis shall be as prescribed by the Contracting Officer.

Payment for furnishing and placing reinforced concrete will be made at the unit price per cubic yard offered therefore in the schedule. The price offered in the schedule shall include the cost of all materials and labor required for the concrete placements including furnishing and placing reinforcing bars and fabric and any associated submittals of bar diagrams.

## SECTION 3.3 - JOINTS AND EDGES IN CONCRETE

### 3.3.1. JOINTS AND EDGES

a. Construction joints.--Construction joints are joints which are purposely placed in concrete to facilitate construction; to reduce initial shrinkage stresses and cracks; to allow time for the installation of embedded metalwork; or to allow for the subsequent placing of other concrete. Bond is required at construction joints regardless of whether or not reinforcement is continuous across the joint.

The location of all construction joints in concrete work shall be subject to approval of the Contracting Officer, and the joints shall be constructed in accordance with the requirements of this paragraph.

b. Expansion joints.--

(1) General.--Expansion joints shall be constructed between the floor slab and the approach aprons and equipment slabs as shown on the drawings.

Preformed bituminous joint filler shall be placed in all expansion joints. The Contractor shall furnish and place the preformed bituminous joint filler. The joint filler shall cover the entire surface of the concrete at each joint, and shall be laid against the concrete and held rigidly in place while the concrete is placed on the other side of each joint. All joints in the joint filler shall be tightfitting butt joints.

(2) Materials.--Preformed bituminous joint filler shall conform to ASTM D-1751.

c. Edges.-- The Contractor shall tool or chamfer edges of concrete where shown on the drawings and elsewhere as required.

d. Cost.--The cost of furnishing all materials and performing all work for constructing construction joints, contraction joints, control joints, and expansion joints and for tooling or chamfering concrete edges shall be included in the price offered in the schedule for the furnishing and placing reinforced concrete.

## SECTION 3.4 - SPECIAL CONCRETE REQUIREMENTS

### 3.4.1. CONCRETE FLOOR HARDENER

a. General.--The Contractor shall furnish and apply concrete floor hardener to the entire floor slab for the pre-engineered carpentry/sandblast shop.

b. Materials.--Concrete floor hardener shall conform, at the Contractor's option, to one of the following:

(1) Fluosilicate crystals.--The fluosilicate crystals used for floor hardener shall be magnesium fluosilicate or zinc fluosilicate, or a combination of both.

(2) Commercial mixtures.--Commercial mixtures of floor hardener shall be a combination of magnesium fluosilicates and zinc fluosilicates with a wetting agent and shall be "equal" to Lithoplate liquid floor hardener manufactured by Protex Industries, Inc., 1331 West Evans Avenue, Denver CO 80223; Saniseal 50 chemical floor hardener manufactured by Martin Marietta Corp., Master Builders Division, 23700 Chagrin Boulevard, Cleveland OH 44122; or Lapidolith chemical floor hardener manufactured by Contech, Inc., Sonneborn Division, 7711 Computer Avenue, Minneapolis MN 55435.

c. Applying liquid floor hardener.--After the concrete floor slab has been cured thoroughly and at such time as approved by the Contracting Officer, the surfaces of the concrete shall be cleaned thoroughly of all dirt, grease, latence, or other foreign matter and shall be allowed to dry, immediately after which three coats of floor hardener shall be applied.

If a commercial mixture of liquid floor hardener is used, the coverage rate and application procedures shall be as recommended by the manufacturer of the liquid floor hardener. Before applying a commercial mixture of floor hardener, the Contractor shall submit two copies of the manufacturer's instructions of rate of coverage and application procedures to the representative of the Contracting Officer at the jobsite.

If fluosilicate crystals are used, the Contractor shall prepare the hardener solution by dissolving fluosilicate crystals in the proportion of 1/2 pound of crystals per gallon of water for the first coat and 2 pounds of crystals per gallon of water for the second and third coats. The hardener solution shall be applied by means of floor mops at a maximum coverage of 100 square feet per gallon per coat.

Each coat of floor hardener shall be spread uniformly, and the presence of pools of the hardener solution shall be avoided. Each coat shall be allowed to dry thoroughly before the next coat is applied. After the last coat has dried, the floor shall be brushed and washed with water to remove any crystals which may have formed on the surface.

d. Cost.--The cost of furnishing and applying concrete floor hardener to the concrete floor slab shall be included in the price offered in the schedule for furnishing and placing reinforced concrete.

### 3.4.2. GROUTING MORTAR

a. General.--Nonsettling grouting mortar shall be furnished and placed as required and shall be in accordance with this paragraph.

b. Nonsettling grouting mortar.--Unless inspection is waived in each specific case, the weighing and preblending of the aluminum powder and cement for the nonsettling grouting mortar and the mixing and placing of the nonsettling grouting mortar shall be performed only in the presence of the Government inspector.

Nonsettling grouting mortar shall be composed of cement, water, sand, and aluminum powder. Cement shall be type I, II, or III Portland cement in accordance with ASTM C150, and shall meet the false-set limitation specified therein. Water and sand shall be in accordance with paragraph 3.2.2 (Materials), respectively, except that sand passing a No. 16 screen shall be used when clearances are such that the specified grading for sand is not suitable. Aluminum powder for use in the mortar shall be ground; shall contain no polishing agents, such as stearates, palmitates, and fatty acids; and shall effectively produce the desired expansion.

Mix proportions of the nonsettling grouting mortar shall be 1 part cement to 1½ parts sand, by weight, for fluid mortar; and 1 part cement to 2 parts sand, by weight, for a plastic mortar; each containing a small amount of aluminum powder as specified below. The water-cement ratio of the mortar shall not exceed 0.50, by weight, and the slump of the mortar shall be the lowest practicable for the space to be filled. The exact mix proportions and water-cement ratio for the mortar will be determined by the Contracting Officer.

The quantity of aluminum powder to be used in the mortar will be governed by the quantity and characteristics of the cement used, and will vary as the placing temperature varies, from about 2 grams of aluminum powder per bag of cement for 90° F placing temperature to about 5 grams at 40° F placing temperature. After weighing, the aluminum powder shall be thoroughly preblended with a small amount of Portland cement before adding to the grouting mortar. This preblended material shall be a uniform blend of 1 part aluminum powder to 50 parts cement, by weight.

c. Preparation of surfaces and placing mortar.--Before placing mortar, the surfaces of base concrete to which the mortar will be bonded shall be roughened and shall be cleaned of all latence, loose or defective concrete, curing compound and other coatings, and other foreign material by effective means, followed by thorough washing with water. If any delay occurs between the washing of the concrete and placing of the mortar, the surfaces shall be lubricated by washing with water immediately before placing of the mortar. The mortar shall be placed, completely filling spaces adjacent to metalwork, as shown on the drawings.

d. Curing.--The exposed surfaces of mortar shall be cured for 72 hours by keeping them covered with moist burlap, damp sand, or by other effective means approved by the Contracting Officer.

Loads shall not be applied to the mortar sooner than the 72 hours after placement and shall be applied only after the mortar has attained a compressive strength of at least 3,000 pounds per square inch. The time required for the mortars to attain this strength will be determined by the Government. Care shall be taken when applying loads on the hardened mortar, and the Contractor shall be responsible for any damage thereto resulting from impact loads when positioning metalwork.

e. Cost.--The cost of all work in connection with placing mortar, and the cost of the cement, aluminum powder, water, and sand for mortar shall be included in the prices offered in the schedule for items of work for which mortar is required.

## DIVISION 4--PRE-ENGINEERED METAL BUILDING

## SECTION 4.1 - PRE-ENGINEERED METAL BUILDING

## 4.1.1. PRE-ENGINEERED METAL BUILDING, GENERAL

The Contractor shall furnish and erect a pre-engineered metal carpentry/sandblast building at the Hoover Dam Warehouse Complex. The building shall be complete with steel framing utilizing straight columns; colored wall and roof panels; doors, and all necessary trim, closures, fasteners, sealants and other materials required for a complete watertight building.

The building shall have the interior dimensions and nominal eave height shown on the specifications drawings. The clear span, bay widths, and other dimensions shall be those shown on the approved submittal drawings. The interior frames shall be single span structures with one of the following framing systems: self-framing, column with single-span or continuous trusses, continuous beam frames, column with rigid frame, or rigid frame type, similar to AISC S335, Type I construction. The end frames shall be column and beam with girts framing into end wall column webs.

The steel framing shall be furnished with the manufacturer's standard shop applied priming paint system. The finish colors used shall be similar to those used on the existing main warehouse at Hoover Dam. The colors shall be chosen by the Government based on samples provided by the building manufacturer.

The building shall have a low profile roof with a slope of 1 inch vertical in 12 inches horizontal.

## 4.1.2. QUALITY ASSURANCE

a. General.--The metal building shall be the product of a manufacturer regularly engaged in the manufacture of pre-engineered metal buildings. The design, fabrication, and materials shall conform to the requirements of these specifications and the requirements of the MBMA (Metal Building Manufacturer's Association) latest edition of the "Metal Building System Manual."

b. Design.--The Structure shall be designed to withstand the loads shown on the drawings, in accordance with the Uniform Building Code, latest edition; and wind and seismic loading in accordance with MBMA-01. Loads shall be combined for determining maximum stress in accordance with MBMA-01.

Allowable stresses may be increased one-third for design-load combinations involving wind.

All structural steel members shall be designed for those sections of the following listed codes as considered to be applicable, by the building manufacturer, as related to design requirements and allowable stress.

- (1) A.I.S.C. "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings."
- (2) A.I.S.1. "Specification for the Design, Fabrication and Erection of Cold-Formed Structural Members for Buildings."
- (3) M.B.M.A. "Recommended Design Practices Manual."
- (4) A.W.S., D1.1 "Structural Welding Code."

Design of the pre-engineered metal building shall be in accordance with MBMA-01.

Deflection of metal roofing and siding panels shall not exceed 1/180 of the span on single span loading under the total live and wind load.

#### 4.1.3. SUBMITTALS

a. Brochures or data.-- Within 20 days after receipt of notice to proceed, the Contractor shall submit to the Government, for selection of panel width, color and architectural rib finish, two sets of brochures or data showing the manufacturer's complete range of colors and rib details for the buildings he proposes to furnish. The Government will select the panel width, color, and architectural rib finish from the brochures and data submitted. The brochures or data shall be labeled and shall be submitted in accordance with Paragraph 1.1.4. (Submittal Requirements) and Table 1A (List of Submittals).

b. Approval drawings and data.- Within 30 days after receipt of notice to proceed, the Contractor shall submit at one time to the Government for approval four sets of checked and coordinated shop drawings and data for the building.

The drawings and data shall include sidewall, endwall, and roof framing plans; elevations; transverse and longitudinal sections through the building; details of roof seams, ridge caps, closures; foundation design; and an anchor-bolt plan. The anchor-bolt plan shall show the size, location, and projection of the anchor bolts.

The drawings and data shall include a complete description of the building materials and accessories including the panel finishes.

The building manufacturer shall furnish a certification, signed by a registered Professional Engineer, stating that the building design is capable of carrying the specified loading conditions. The Contractor shall submit the certification with the approval drawings and data.

The time required for approval of the drawings and data as specified in Paragraph 1.1.4. (Submittal Requirements) and Table 1A (List of Submittals) will not begin until the Government receives all of the required approval drawings and data.

Any fabrication or procurement of materials by the Contractor before approval of the drawings and data will be at the Contractor's risk.

The Government shall have the right to require the Contractor to make any changes which may be necessary in the opinion of the Government to make the finished construction conform to the requirements of these specifications without additional cost to the Government.

Approval by the Government of the Contractor's drawings and data shall not relieve the Contractor of any part of the Contractor's obligations to meet the requirements of these specifications or of the responsibility for the correctness of the Contractor's drawings and data.

One set of the drawings and data will be returned to the Contractor either approved, not approved, or conditionally approved, and also marked to indicate changes if required. Drawings and data shall be resubmitted for approval if directed.

C. Final erection drawings and instructions--At least 20 days before beginning erection of the building, the Contractor shall submit the building manufacturer's erection drawings and instructions in accordance with Paragraph 1.1.4. (Submittal Requirements) and Table 1A (List of Submittals).

#### 4.1.4. MATERIALS

a. General.--Materials and accessories for the metal building shall be in accordance with the applicable requirements of sections 7 and 8, respectively, of the "Recommended Guide Specifications for Metal Building Systems," as contained in the MBMA "Metal Building Systems Manual" and as specified below.

b. Primary members.--Steel for hot-rolled mill shapes, plates, and bars shall be in accordance with ASTM A 36.

Hot-rolled steel sheet, plate, and strip of welded assemblies shall conform to ASTM A 529, Grade 42.

Steel tubing shall conform to ASTM A 501, Grade B.

Diagonal-rod bracing steel shall be in accordance with ASTM A 572, Grade 60. Threads shall be rolled or cut. Nuts shall be semi-finished hex-head.

Anchor bolts shall be uncoated, carbon steel in accordance with ASTM A 36.

c. Secondary members.--Members shall conform to ASTM A 570, Grade 50. Shop prime paint shall be the final finish. Minimum thickness of members shall be 16 gauge. Members shall be pre-punched for bolted field assembly.

d. Roofing and siding.--Factory insulated roof and wall panels shall be units having a modular cover width of 40" and a maximum "U" factor of 0.055 BTU/HR/SF/°E.

The wall panels shall consist of color-coated galvanized steel facings and a rigid urethane foam insulation, such that the core and facings act compositely to form a single structural unit. The "U" factor shall be determined by test in accordance with ASTM Specification C-236 with an outside temperature of 13° F and an inside temperature of 78° F. Under these conditions the minimum inside surface temperature shall be 70° F.

Galvanized steel for the exterior face of wall panels shall conform to ASTM Specification A-446 Grade A (33,000 psi yield) G-90 coating class.

Galvanized steel for the interior face of wall panels shall conform to ASTM Specification A-446 Grade A (33,000 psi yield) G-60 coating class.

The insulating core for roof and wall panels shall be closed-cell rigid polyurethane foam having a nominal density of 2 pounds per cubic foot. The foam shall have a minimum continuous service temperature of 200° F and shall exhibit a maximum volume change of 6 percent when aged for a period of 21 days at 1400E and 90% relative humidity.

Roof panels shall conform to ASTM A 446, Grade D, not less than 24-gauge thick, before coating. Zinc coating shall conform to ASTM A 525, G90.

Roofing sheets shall be of sufficient length to bridge at least 3 purlin spans plus the required end lap. Siding sheets shall extend full height as shown on the contract drawings, without horizontal joints. Roofing sheets shall extend full width from ridge to eave of the building. Roofing and siding sheets shall have concealed, semi-concealed, or exposed fasteners on exterior. Exposed fasteners shall be colored to match the roof and wall sheeting.

Panel to structural and panel to panel fasteners shall be No. 12 x 1" selfdrilling, self-tapping, hex head, steel screws with formed steel washer and an elastomeric sealing washer. Roof and wall fasteners shall be zinc plated with a clear chromatic dip post treatment. Wall fasteners shall be colored to match the wall color.

e. Mastic.--Standard mastic shall be preformed bead type meeting or exceeding Federal Specification TT-C-1796, Type II, Grade B.

#### 4.1.5. ERECTION AND INSTALLATION

The pre-engineered metal building shall be erected according to the specifications requirements and the final approved erection drawings and instructions. The building shall be erected under the supervision of a representative of the building manufacturer. Damaged or defective materials shall not be installed. The repair of damage which is due to the operations of the Contractor shall be made by the Contractor without additional cost to the Government.

Primary and secondary framing shall be bolted-up using A325 high-strength bolts.

At roof side laps, a permanently pliable 1/4" bead of mastic shall be placed in the mastic grove of the under lapping rib in a bead of constant cross section to ensure continuous contact of

mastic with the upper and lower panels. At roof end laps, one or two beads, 1/4" each, permanently pliable mastic shall be applied.

Fasteners for roof panels shall be installed in the flat of the panel at a spacing of 1 foot on center except at end laps and terminal ends, where the spacing shall be a nominal 6 inches on center. Fasteners for wall panels shall be installed in the flat of the panel at a spacing of 1 foot on center.

Damaged or defective areas of paint or galvanizing shall be cleaned and repaired in accordance with recommendations of the building manufacturer.

Care shall be taken to ensure that all parts are installed in correct position and alignment. The building anchor bolts shall be located accurately and shall be held in correct position and alignment during placing and setting of the concrete.

Baseplates shall be leveled or aligned carefully, adjusted to correct alignment and grade with steel shims as necessary and rigidly secured in place. Spaces under the baseplates shall be filled completely with grouting mortar according to Paragraph 3.4.2. (Grouting Mortar).

The ridge, eaves, corners, and panel joints shall be closed and sealed watertight.

#### 4.1.6. HINGED DOORS

a. General.--The Contractor shall furnish and install standard hinged doors at the locations shown on the specification drawings or approved submittal drawings. The doors shall be 3'-0" x 7'-0" x 1-3/4", single swing, flush panel metal doors.

b. Door and Frame.--The 3-foot 0-inch by 7-foot 0-inch hollow core steel doors shall meet the requirements of SDI-100 published by the Steel Door Institute. The door shall be grade III, model 3, galvanized steel, with flush end closure treatment at top and internal construction of polyurethane core, polystyrene core, or steel vertical stiffeners and fiberglass insulation. The frame shall be a hollow steel frame constructed of 14-gauge, minimum, galvanized steel. The doors and frames shall be bonderized and furnished with one finish coat of oven baked rust inhibiting alkyd white enamel paint meeting the manufacturer's specifications.

All door hardware shall be of standard commercial quality and the design and finish shall be subject to the approval of the Contracting Officer. Hinges shall be full mortise.

Each door shall be provided with an aluminum threshold and a prepainted white drip. The junction of the door frame and wall panels shall be made weathertight by the use of a trim and sealant. The cross section of the trim shall be subject to approval of the Contracting Officer.

c. Cost.--The cost for furnishing and installing hinged doors, including all labor and materials, shall be included in the lump sum price offered in the schedule for furnishing and erecting the pre-engineered metal building.

#### 4.1.7. INSULATED STEEL ROLLING DOORS

a. General. -- The Contractor shall provide manually-operated insulated steel rolling doors with weatherstripping for the shop building as shown on the drawing. The insulated steel rolling doors shall be complete with hood, barrel, door curtain, guides, counterbalance assembly, manual operator assembly, weather seals, and all accessory material required for complete installation.

The steel rolling doors shall be a product of a manufacturer regularly engaged in the manufacture of insulated steel rolling doors of the type specified. The door curtain shall be inside mounted between jambs with outside face flat in appearance.

The insulated steel rolling doors shall be designed to minimize the infiltration of wind, water, sand and dust and shall be designed for a wind pressure of not less than 25 pounds per square foot. The door shall be mounted on the interior face of the wall.

b. Submittals. -- Submittals shall be in accordance with this paragraph and paragraph 1.4.3. (Submittal Requirements).

(1) Shop drawings. -- At least 30 days before shipment to the jobsite, submit shop drawings and data covering details of the insulated steel rolling doors and hardware. Show size and location of door framing and reinforcement; gages of steel, thickness and type of insulation, "R" factor of door curtain, details and location of manual operator and door hardware, details of guides and brackets, details of weatherstripping, and other details covering fabrication and installation of the doors and frames.

(2) Product data. -- Include manufacturer's catalog sheets, specifications, color charts, and information showing that material and equipment are in accordance with these specifications.

(3) Installation data. -- Submit manufacturer's installation data.

(4) Maintenance data. -- Submit manufacturer's maintenance data.

c. Materials. -- The insulated steel rolling doors shall be the 625 Series "Stormtite" insulated rolling door manufactured by Overhead Door Company, P.O. Box 809046, Dallas TX 75380-9046; or the "Thermal-Door" insulated rolling door manufactured by Atlas Door Corporation, 116 Truman Drive, Edison NJ 08818; or equal, having the following salient characteristics:

(1) Structural steel. -- ASTM A 36.

(2) Sheet steel. -- ASTM A 526 with not less than G-90 zinc coating. General requirements shall be in accordance with ASTM A 525.

(3) Guides. -- Fabricated of structural steel angles not less than 3/16-inch thick. The depth of guides shall provide adequate slat penetration for the specified wind loading. Guides shall be furnished with windlock bars to prevent the curtain from leaving the guide and shall be fully weatherstripped.

(4) Brackets. -- Not less than 1/4-inch thick steel plate to support the counter balance assembly and hood.

(5) Counter balance. -- Helical torsion springs housed in a steel pipe barrel, with a deflection not to exceed 0.03 inch per foot of width.

(6) Hood. -- Minimum 24-gage hot galvanized phosphate-treated steel, formed to fit brackets, and reinforced top and bottom, with intermediate hood supports where required by door width. A neoprene hood baffle shall be furnished to prevent passage of air through the hood.

(7) Curtain. -- Assembled of interlocking double-face sheet steel slats. Flat slats shall be formed from sheet steel with a thickness as required by the manufacturer's design to span the width of the door opening and to withstand the specified windloading. The void formed in the slat by the double-face steel shall be filled with foamed-in-place CFC-free polyurethane foam insulation. Slat shall be provided with windlocks.

The coefficient of thermal resistance (R-factor) for the door curtain shall equal or exceed 5.8.

(8) Operator. -- Manually-operated chain hoist with galvanized steel chain.

(9) Locking. -- Interior bottom bar slide bolt lock for doors and chain keeper locks for chain hoist.

d. Installation. -- The steel rolling doors, including accessories, shall be installed by the door manufacturer's authorized representative in accordance with the approved drawings. Installation of the insulated steel doors shall be such that the door openings are closed to wind, water, and dust when the door is closed and seated. Before acceptance of the work, the Contractor shall test the operation of each door and shall correct any defects.

e. Painting. -- All ferrous and galvanized surfaces of the insulated steel rolling doors and accessories shall receive the door manufacturer's shop-applied primer system and a factory-applied finish coat system. Color will be selected by the Government from the door manufacturer's standard colors. Damage to the paint finish shall be repaired by the Contractor in accordance with the door manufacturer's instructions.

f. Cost. -- The cost of furnishing and installing the insulated steel rolling doors shall be included in the lump-sum price offered in the schedule for furnishing and erecting the pre-engineered metal building.

#### 4.1.8. PAYMENT

Payment for furnishing and erecting the pre-engineered metal building will be made at the lump sum price offered therefor in the schedule, which price shall include the cost of all labor, materials, equipment and incidentals, required for complete erection of the building as required by the building manufacturer, as shown on the drawings and herein specified.

### SECTION 4.2 - GYPSUM BOARD SYSTEM

#### 4.2.1. GYPSUM BOARD WALL

a. General. -- The Contractor shall construct a gypsum board system for the partition wall in the preengineered metal building as shown on drawings No. 3(45-301-6575).

The system shall be complete with all accessories required to install and finish the wallboard installation.

b. Quality assurance. -- Maintain copies of ASTM C 754 and GA 216 at jobsite during framing and drywall work,

c. Product delivery, storage, and handling. -- Deliver, store, and handle materials in accordance with GA 216.

d. Environmental requirements. -- Maintain environmental conditions in accordance with GA 216.

f. Materials. -

(1) Framing materials:

(a) Studs, blocking and runners. -- ASTM C 955, Galvanized steel, c-shaped studs and runners, No. 20 gauge, minimum. Studs are lipped.

(2) Fasteners. -

(a) Screw fasteners. -- Corrosion-resistant screws recommended by manufacturer for required construction.

(b) Powder-actuated fasteners. -- Low-velocity, powder-actuated fasteners with zinc-plated finish. Type and size suitable for required construction.

(3) Gypsum board materials. -- ASTM C 36, standard gypsum wallboard, with tapered edges, plain face, thickness as shown on the drawings.

## (4) Gypsum board accessories. -

(a) Drywall screws. -- ASTM C 1002, type S, not less than 3/8 inch longer than total thickness of board to be penetrated.

(b) Joint compound and joint tape. -- ASTM C 475.

(c) Edge trim. -- Galvanized steel bead sized to match board thickness, 200 Series Metal Trim by United States Gypsum Co.; or equal.

g. Wall framing installation. -- Erect in accordance with ASTM C 754, except as specified. Erect plumb and in alignment.

Attach framing to CMU and metal building framing with fasteners as recommended by the manufacturer.

Make screw attachments for connections. Do not use crimping.

Runners shall be attached to the CMU wall with power-driven fasteners spaced not more than 18 inches on center. Framing shall be attached to the building framing with fasteners spaced not more than 16 inches on center.

Apply and mechanically attach fasteners in accordance with Table 4A.

Table 4A. -- Gypsum Board Application

Location	GA 216 Application	Maximum Screw Method spacing, inches
Walls	Parallel or perpendicular	12

Place edge trim where gypsum board abuts dissimilar materials.

Provide a level 4 finish in accordance with GA 214.

Wall board panels shall be installed perpendicular to the studs with ends bearing on supports. Wall panels shall be screw attached to the framing with screws spaced not more than 12 inches on center at all supports.

Panels shall be closely fitted at the joints. Panel edges or ends shall have a minimum of five-eighths bearing at supports. Cut panel edges shall not be butted to tapered edges.

End joints shall be staggered in successive courses of panels. Joints shall be staggered on opposite sides of partition wall.

k. Painting. -- Paint in accordance with Division 8 (Painting).

1. Cost. -- The cost of furnishing and installing gypsum board system shall be included in the lump sum price offered in the schedule for furnishing, and erecting the pre-engineered metal building.

## DIVISION 5--ELECTRICAL

## SECTION 5.1 - ELECTRICAL

## 5.1.1. ELECTRICAL CONDUIT SYSTEMS

a. General.--The Contractor shall furnish and install electrical conduit, accessories, and materials required to complete the embedded and exposed conduit systems. All materials used in the conduit system shall be UL listed and rated for their intended purposes or shall be labeled by a nationally recognized testing laboratory (NRTL) accredited by the Federal Occupational Safety and Health Administration (OSHA) when applicable. Conduit accessories for conduit shall include:

- (1) Fittings such as caps, connectors, couplings, nipples, reducers, elbows, pipe plugs, locknuts, bondnuts, bushings, seals, and any other fittings required to complete the electrical conduit systems.
- (2) Threaded joint compound; protective sealant; materials for sealing ends of conduits terminating at outdoor boxes, panelboards, or cabinets; supports and clamps, complete with bolts, washers, and nuts; and other devices required to complete the electrical conduit systems and to fasten, clamp, attach, and support each conduit in place.

b. Materials.--The materials for the electrical conduit installation shall conform to the following requirements:

- (1) Rigid steel conduit, zinc coated.
- (2) Metal conduit fittings.
- (3) Plastic-coated rigid-steel conduit.--The conduit shall be zinc coated, with a factory-applied, bonded, plastic compound protective coat at least 0.04 inch thick uniformly around conduit. All elbows, fittings, couplings, hangers, and other accessories shall have an equal bonded coating. The fittings and couplings shall be sleeved to provide a watertight joint. The solvent that will be used to make the fittings and couplings watertight shall be as recommended by the manufacturer.
- (4) Conduit sealing bushings.--The bushings shall seal against liquid, gas, and vapor seepage; and shall be non-toxic, non-shrinking, and fire retardant.
- (5) Protective sealant.--The sealant shall be water repellent and shall be resistant to peeling and cracking.
- (6) Exposed outlet bodies and boxes.--The bodies and boxes shall be cast iron, malleable iron, or cast aluminum for exposed conduit systems.

(7) Malleable metal outlet boxes.--The boxes shall be in accordance with the following:

(a) Single gang. -- Single-gang device boxes and junction boxes shall be rectangular, single-gang, deep-wiring device outlet boxes with threaded hub connections for rigid steel conduit. Each box shall have four 1-inch threaded hubs, and shall be furnished complete with a 1-inch-deep cast or malleable metal extension ring. Boxes and extension rings shall be iron alloy with corrosion-resistant finish. Boxes shall be provided with 1-inch bushed elbows where indicated on the drawings, plugs for unused openings, and reducers as required.

(B) Type GRF.--The luminaire outlet boxes shall be 4-inch-round type outlet boxes approximately 3-1/8 inches deep, with threaded-hub connections for rigid steel conduit. Each box shall have four 1-inch threaded hubs, shall have plugs for all unused openings, shall have reducers as required, and shall be tapped for a 3/8-inch fixture stud. The boxes shall be an iron alloy with a corrosion-resistant finish.

(8) Fabricated sheet steel boxes.--Boxes shall consist of large junction, pull, or conduit boxes, excluding outlet boxes to contain wiring devices or to accommodate lighting fixtures, and shall be fabricated from sheet steel not less than No. 14 Manufacturer's Standard gauge. The cover for each box shall be attached with a heavy gauge continuous hinge. Stainless steel clamps shall be provided on the remaining three sides of the cover to ensure a watertight seal. Boxes exposed to weather shall be weather-resistant and watertight NEMA Type 4. Covers shall be provided with oil-resistant gaskets.

c. Installation.--The conduit systems shall be installed as shown on the specification drawings and in accordance with the applicable requirements of the NEC, 1996, and the NFPA-101, 1997. The Contractor shall be responsible for determining the exact locations of embedded conduit stub-ups based on the equipment being furnished. The Contractor shall determine the routing of exposed conduit when it is not shown on the drawings.

The conduit shall be installed with all necessary fittings and supports, and the bends shall be gradual and smooth to permit pulling insulated conductors without undue stress or damage to these conductors or conduit. Conduit runs and bends shall be free from kinks, indentations, or flattened surfaces. Metal conduit bends made in the field shall be bent cold to prevent damage to protective coating. Burrs and sharp corners at the ends of metal conduit shall be removed.

Male threads of rigid metal conduit joints shall be coated with a suitable graphite or zinc sealing material before making joints, and shall be tightened securely to ensure electrical continuity and to prevent the entrance of moisture or foreign material.

Bushings or chase-type nipples shall be installed on the ends of conduit to protect the insulation of the insulated conductors from abrasion. Locknuts and bondnuts shall be installed to provide tight ground connections between conduit and boxes, panelboards, and cabinets.

The ends of conduits terminating at all boxes and panelboards shall be sealed with a sealing material or with sealing bushings to prevent air circulation and entrance of rodents through the conduits into the boxes or panelboards.

Conduit terminated at horizontal and vertical surfaces shall be stubbed two inches above the finished floor level or wall surface and shall be terminated with a coupling and a plug. The two-inch stubout and approximately 1 foot of the embedded conduit shall be wrapped with corrosion tape. The plug shall be replaced with a bushing or a Chase-type nipple before installing cable.

Unless shown otherwise, conduit to be embedded in concrete shall be rigid steel conduit. Conduit and conduit fittings to be embedded in concrete shall be held securely in position while the concrete is being placed. The ends of conduit shall be protected to prevent the entrance of concrete, sand, or other foreign material. The ends of embedded conduit shall be terminated with couplings and pipe plugs or with insulating bushings and caps.

Within 24 hours after removal of forms, conduit runs shall be swabbed with clean dry rags until thoroughly cleaned and dried. The threads of the removed plugs shall be greased, and the plugs shall be replaced and shall be left in place to prevent entrance of water or foreign material until the insulated conductors are installed. Conduit boxes shall be sealed with a rubber gasketed blank cover.

Wall penetration seals shall be furnished and installed for conduits entering the structure below grade. The seals shall be installed in accordance with the manufacturer's instructions.

Exposed conduit runs shall be straight and shall be parallel with each other and with the centerline of the room or structure. Exposed conduit shall be rigidly supported from the wall or ceiling within 3 feet of each outlet box, junction box, cabinet, or fitting and at intervals of not more than 5 feet. Installation of exposed conduit shall include, where required, drilling holes in the bottom, side, or top enclosures or plates of other electrical equipment. Exposed conduit shall be tightened securely and shall be supported rigidly in place, and connections to outdoor boxes shall be watertight. Metal conduit shall not be welded to structural steel or conduit supports.

Metal conduit buried directly in earth shall be plastic-coated conduit. Joints shall be watertight and shall be coated or covered in accordance with manufacturer's instructions. Plastic-coated conduit shall be securely tightened with a plumbers-type strap wrench. Damaged portions of the protective coat shall be repaired or covered in accordance with the manufacturer's instructions. Where buried conduit is to connect to embedded conduit or is to extend above ground, the bonded covering shall extend at least 3 inches into concrete or above the ground surface. Solvent shall be used when installing fittings and couplings to permanently bond the sleeves to the plastic coating of the conduit.

Bending of plastic-coated conduit shall be in accordance with the manufacturer's recommendations. If the manufacturer warns of possible damage to the conduit or the plastic coating when bending larger sizes, factory bends shall be used.

Buried electrical conduit shall be buried at a depth of 24 inches. All buried electrical conduit shall have 2 inches of sand or fine earth placed around each conduit. The remaining portions of the trenches shall be backfilled and compacted as required to protect the conduit.

d. Cost.--Cost for furnishing and installing the various types and sizes of electrical conduit shall be included in the lump sum price offered in the schedule for furnishing and installing the electrical system.

#### 5.1.2. INSULATED CONDUCTORS, 600 VOLTS OR LESS

a. General.--The Contractor shall furnish and install insulated conductors, 600 volts or less, in accordance with this paragraph and as shown on the drawings.

(1) Exceptions.--The insulated conductors, 600 volts or less, paragraph does not include the material requirements for the following cable and wire, which are provided for elsewhere in these specifications as indicated; however, the wire and cable listed below shall be installed in accordance with the applicable requirements of this paragraph.

(a) Luminaire wire.--Paragraph 5.1.3.c.(6).

(2) Definitions.--For the purposes of this paragraph, the following definitions shall apply:

(a) Cable.--Cable, cables, wire, or wires of one or more insulated conductors.

(b) Power cable.--Cable that is used for power loads including receptacle outlets; motors; alternating- and direct-current distribution circuits; heating, ventilating, air-conditioning and lighting circuits; and cable that is used for controlling heating, ventilating, air-conditioning, and lighting equipment.

(c) Indoor cable.--Cable with its entire length indoors.

b. Submittals.--Submittals shall be in accordance with this subparagraph, and paragraph 1.1.4. (Submittal Requirements).

The Contractor shall submit the data listed below.

(1) Manufacturer's data.

(2) Meggar test reports.

## c. Materials.--

## (1) Cable, general.--All cable shall:

- (a) Be manufactured no more than 24 months prior to award date.
- (b) Be round, except for 2-conductor cable with parallel conductors.
- (c) Have ASTM class B or C copper conductor.
- (d) Have kcmil, AWG, or MCM designation.
- (e) Have coverings or insulation suitable for installation in the vertical position without injury to the covering or deformation of the insulation when supported in accordance with NEC article 300-19.
- (f) Have stranded conductors.

## (2) Color code for indoor lighting cable.--All No. 10 AWG and smaller single-conductor cable used in branch circuits shall have colored or identified insulation as follows:

Phase A - black or orange\*  
 Phase B - red or yellow\*  
 Phase C - blue or brown\*  
 Neutral - white or gray\*

\* To be used when more than one multiwire branch circuit is contained in a single conduit.

## (3) Outdoor power cable. -- This cable shall:

- (a) Be UL listed and shall bear the UL-type label on the outer surface in accordance with NEC.

## (4) Determination of conductor sizes.--The Contractor shall determine all conductor sizes, except where shown on the drawings or specified, in accordance with NEC, 1996 and the following requirements (in the event of conflict between NEC, 1996 and the following, the more stringent requirement shall apply):

- (a) Minimum conductor size shall be No. 12 AWG except for the following:
  - (aa) Lighting circuits.--No. 12 AWG or larger.
  - (bb) Power.--No. 12 AWG or larger.

(b) Conductor sizes for power and lighting circuits shall be determined in accordance with NEC based on 60° C conductor temperature for sizes No. 1 AWG and smaller and 75° C conductor temperature for sizes No. 1/0 AWG and larger.

d. Installation.--The Contractor shall install the cables in accordance with the drawings, the requirements of these specifications, and the requirements of NEC, 1996 and NESC, 1997, where applicable.

Sufficient length shall be left at the cable ends to make connections conveniently to equipment, fixtures, and devices. Spare single conductors at each end of a multiconductor cable shall be retained in a length equal to the longest single conductor of the multiconductor cable. Conductors in current transformer cable shall be retained in sufficient length to reach the farthest terminal used to select current transformer ratios.

At the termination point of multiconductor cable, conductors shall be formed into neat packs and shall be laced or tied with self-locking cable ties.

The cable shall not be pulled into conduits until the conduit runs have been cleaned and are free from obstructions and sharp corners. A clean, dry, tight-fitting rag shall be drawn through conduit immediately before installing cable. The cable shall be installed so as to prevent cuts or abrasions in insulation or protective covering, or kinks in cable.

Gradual and uniform pulling stresses only will be permitted on cable. Where a lubricant is needed as an aid to the pulling, only soapstone or other suitable material not injurious to cable sheath shall be used. The Contractor shall install cable without exceeding allowable pulling tensions and sidewall pressures recommended by the cable manufacturer. Cable damaged during installation shall be removed and replaced by and at the expense of the Contractor.

No splices will be allowed in any single or multiconductor control cables. Splices will only be allowed in junction boxes at devices where wiring pigtails are provided from the manufacturer. Splices shall only be made where approved by the Contracting Officer's technical representative and shall meet the applicable requirements of NEC, 1996.

All conductors, whether single-conductor cables or individual conductors of multiconductor control, telemetering, instrumentation, and power cables shall be marked at each end with the conductor designation on the first line followed by the conductor destination device and terminal number on the second line. The spare conductors of multiconductor cables shall be machine lettered with the cable designation and the word "SPARE". The markers shall have designations that have been machine lettered. The markers shall be white in color and shall be of the self-laminating-vinyl type or of the heat-shrink type.

The contractor shall make all electrical connections to each piece of equipment or device.

e. Cost.--Cost for furnishing and installing the various types and sizes of insulated conductors shall be included in the lump sum price offered in the schedule for furnishing and installing the electrical system.

### 5.1.3. LIGHTING SYSTEMS

a. General.--The Contractor shall furnish and install the lighting systems consisting of luminaires, lamps, luminaire wire, wiring devices, luminaire hanger rods, mounting hardware, and all other equipment and materials necessary to provide complete and operational lighting systems.

b. Submittals.--Submittals shall be in accordance with this subparagraph, and paragraph 1.1.4. (Submittal Requirements).

The Contractor shall submit the data listed below.

(1) Approval manufacturer's data for the luminaires, light switches, convenience receptacles (indoor-120 VAC, outdoor-120 VAC, and indoor-240 VAC), and interior and exterior cover plates.

c. Materials.--

(1) Luminaire Type A .--

(a) Manufacturer.--The luminaires shall be as manufactured by DayBrite Lighting, PO Drawer 1687, Tupelo MS 38802-1687, catalog Nos. FLB-2124-4U and FL-173; or equal, having the following salient characteristics.

(aa) Description.--Each luminaire shall be a suspended-mounted, industrial fluorescent type with a white polyester powder finish on the reflector. The luminaires shall have an internal fuse and shall provide approximately 25% uptight.

(bb) Lamps.--Each luminaire shall have two F40CW rapid start lamps.

(cc) Voltage.--The voltage shall be 120 volts.

(dd) Ballast.--The ballast shall be a 120 volt, 2 lamp, 430 milliampere type.

(ee) Size.--The luminaires shall be a nominal 1 foot by 4 feet.

(ff) Mounting.--The luminaires shall be suspended-mounted by luminaire hanger rods securely attached to joists and to the raceway channel mounted on the back of each luminaires

(gg) Accessories.--Each luminaire shall have one wire guard and one fuseholder with a fuse.

- (2) Data submitted for approval on luminaires other than those specified above must include tabulated angle/candlepower photometric distribution data. Multiplane data shall be furnished for luminaires having an asymmetrical distribution.
- (3) All luminaires shall be equal to the luminaires described. The luminaires shall be furnished complete with all lamps and accessories specified in the luminaire data tabulation and shown on the drawings. Luminaires requiring special modifications shall be completely modified and prewired by the manufacturer.
- (4) Ballasts for fluorescent lamps.--The ballasts for the fluorescent lamps shall be class P, high (90 percent minimum) power factor type; shall be rated 430 milliamperes; and shall be suitable for operation on 120 volts, 60 hertz, alternating current. Each ballast shall have both UL and CBM/ETL labels and shall have a 2-year warranty.
- (5) Fluorescent luminaire fuses.--The fuseholders for the fluorescent luminaires shall be rated 10 amperes, 300 volts and shall have a positive disconnect at the luminaire for servicing. The fuseholders shall be incorporated within the ballast compartment of the luminaire at least 12 inches from the ballast. The fuses for the suspended luminaires shall be externally accessible. The fuseholders shall be Buss type HLR; or equal. The fuses shall be of the fast-acting, single-element type and shall have ratings as required for proper protection of the ballasts. The fuses shall be Buss type GLR; or equal.
- (6) Luminaire wire.--The luminaire wire shall be of the 600-volt, stranded, single-conductor, copper type. The insulation shall be equal to that of the ballast leads. The luminaire wire shall be in accordance with the NEC, 1996, article 402.
- (7) Luminaire hanger rods.--The luminaire hanger rods shall be 3/8 inch in diameter, shall be standard commercial quality, and shall be continuous-thread type steel rods. The hanger rods shall be a continuous length and shall be provided with nuts and locknuts as required.
- (8) Light switches.--
- (a) Manufacturer.--The light switches shall be as manufactured by Pass & Seymour, Syracuse NY 13221; Hubbell Inc., Bridgeport CT 06605; Challenger Circle F Inc., PO Box 591, Trenton NJ 08604; or equal, having the following salient characteristics:
- (aa) Description.--The switches shall be NEMA WD 1, heavy-duty, AC only, general use snap switch, ivory type with an impact resistant plastic toggle handle. Two-way switches shall be provided as required by the drawing.
- (bb) Wiring terminals.--Screw type terminals only shall be provided for wiring. A screw terminal shall be provided for grounding.

(cc) Voltage rating.--The voltage rating shall be 120/277 volts, alternating current.

(dd) Current rating.--The current rating shall be 20 amperes.

(9) 120 volt indoor and outdoor convenience receptacles.--

(a) Manufacturer.--The receptacles shall be as manufactured by Pass & Seymour, Syracuse NY 13221; Hubbell Inc., Bridgeport CT 06605; Challenger Circle F Inc., PO Box 591, Trenton NJ 08604; or equal, having the following salient characteristics:

(aa) Description.--The receptacles shall be NEMA WD 1, heavy-duty, general use, duplex receptacles.

(bb) Wiring terminals.--The terminals for wiring shall be of the screw type only for No. 10 wire maximum.

(cc) Device body.--The body shall be of the ivory, impact resistant, plastic type.

(dd) Configuration.--The configuration shall be NEMA WD 6 type as specified and as shown on the drawings.

(ee) Convenience receptacle.--The convenience receptacle shall be a duplex, NEMA Type 5-20R.

(10) 240 volt receptacles.--

(a) Manufacturer.--The receptacles shall be as manufactured by Pass & Seymour, Syracuse NY 13221; Hubbell Inc., Bridgeport CT 06605; Challenger Circle F, Inc., P.O. Box 591, Trenton NJ 08604; or equal, having the following salient characteristics:

(aa) Description.--The receptacles shall be straight-blade type, heavy-duty, general use, duplex receptacles.

(bb) Wiring terminals.--The terminals for wiring shall be of the screw type only for No. 6 wire maximum.

(cc) Device body.--The body shall be of the ivory, impact resistant, plastic type.

(dd) Configuration.--The configuration shall be NEMA 6 type as specified and as shown on the drawings.

(ee) Convenience receptacle.--The convenience receptacle shall be a duplex, NEMA Type 6-20, 6-30, and 6-50.

(11) Coverplates.--

(a) Manufacturer.--The coverplates shall be as manufactured by Pass & Seymour, Syracuse NY 13221; Hubbell Inc., Bridgeport CT 06605; Challenger Circle Inc., P.O. Box 591, Trenton NJ 08604; or equal, having the following salient characteristics for each type required:

(aa) Single-gang coverplates.--The single-gang coverplates shall be stainless steel, type 302 and shall be 0.040 inch thick with satin finish.

(bb) Weatherproof duplex receptacle coverplates.--The weatherproof duplex receptacle coverplates shall be specification grade cast aluminum coverplates. The coverplate shall have two single spring-loaded covers, each of which close when the plug is removed. The coverplate shall be mounted in the vertical position and still maintain its weatherproof capability.

(12) Miscellaneous materials.--For materials shown on the drawings but not covered herein by detailed specifications, the Contractor shall furnish standard commercial grades of materials that are satisfactory to the Contracting Officer.

d. Installation.--The lighting systems shall be installed in accordance with this subparagraph, the applicable requirements of paragraph 5.1.1, Electrical conduit Systems, and in the locations shown on the drawings.

e. Cost.--Cost for furnishing and installing the lighting system and making electrical connections to the lighting systems will be made at the lump sum price for furnishing and installing electrical system in the schedule, which price shall include the cost of all labor and materials required by this paragraph, except grounding.

5.1.4. DISTRIBUTION PANELBOARD

a. General. - The Contractor shall furnish and install a 480-volt distribution panelboard in the location shown on drawing No. 3 (45-301-6575).

The panelboard shall be in accordance with NEMA publication No. PB1, Federal Specification W-P-115A, and as specified.

The panelboard shall be factory assembled and completely installed, connected, and made ready for normal operation. The panelboard shall be rigid, self-supporting, dead-front, indoor, dustproof type for surface mounting.

The panelboard shall be the air circuit breaker type with incoming main circuit breakers.

The panelboard shall be of the sectional type with interchangeable units, permitting the substitution of breakers of larger rating.

The panelboard will be complete with enclosures, air circuit breakers (bolt-on), terminal blocks, nameplates, mounting materials, and all other required accessories.

Except where indicated on the drawings, the Contractor shall determine the rating of the air circuit breaker thermal protective devices in accordance with equipment requirements and the requirements of NEC, 1996. Also, the Government reserves the right to change the ampere ratings of the thermal protective devices, within the same price group for any breaker, at the time the drawings are submitted for information. Breaker frame sizes shall be as shown on the drawings. Spare breakers shall be furnished as shown on the drawings.

Panelboard schematic diagrams are shown on drawings No. 6 (45-301-6578).

b. Materials. -

(1) Enclosures. - The enclosure shall have welded joints and shall be galvanized after fabrication. The steel construction of the enclosure shall meet one of the following requirements:

- (a) Enclosures with a maximum dimension less than 20 inches shall be constructed of sheet steel not lighter than No. 16 United States Standard gauge.
- (b) Enclosures with a maximum dimension more than 20 inches shall be constructed of sheet steel not lighter than No. 20 United States Standard gauge.

Enclosed doors shall be furnished with latch and lock. The locks shall be keyed alike, and two keys shall be furnished for each door.

(2) Air circuit breakers (bolt-on). - The circuit breakers shall be in accordance with NEMA publication No. AB1 and Federal Specification WC-375A.

Each air circuit breaker shall be trip free and shall be furnished with thermal instantaneous overload trip devices. The circuit breakers for 480-volt service shall have an interrupting rating of not less than 18,000 symmetrical amperes minimum.

The circuit breakers shall be single, 2, or 3 pole, as required, and shall be furnished to supply power for the services as indicated on drawing No. 5 (45-301-6577) and drawing No. 6 (45-301-6578).

(3) Terminal blocks. -

- (a) Heavy-duty terminal blocks with barriers shall be furnished and installed for external supply cables.

(b) Terminal blocks for control wiring shall be rated at least 600 volts and 25 amperes, shall be suitable for use with No. 8 AWG wire, shall be molded-block type to accommodate ring lugs 1/2 inch wide (outer diameter) at the terminal screws, shall be furnished with binding-head or washer-head screws having serrated or grooved contact surfaces or having lockwashers, and shall be furnished with molded insulating barriers between terminals. Each terminal block shall have a removable marking strip and cover.

Examples of terminal blocks meeting the above requirements are:

Buchanan catalog No. B104T through B112T Marathon catalog Nos. 1604116 through 1612116 General Electric Co., type EB-25.

(c) Terminal block arrangement and location shall be such that coming and outgoing cables can be supported. Adjacent rows of terminal blocks shall be separated at least 6 inches edge to edge and at least 6 inches from sides, top, or bottom of the cabinet.

(d) Approximately 25 percent spare terminals shall be provided on each terminal block for terminating spare conductors in each control cable and for possible future use.

(e) Marking strips shall be provided for terminal blocks with conductor designations engraved or printed with a permanent marking fluid. One spare blank marking strip shall be furnished with each terminal block.

(4) Accessory options. --

(a) Interior busbar shall be copper bus with required rating for this 480 volt distribution panel board.

(b) Equipment ground shall be copper, box bonded.

(5) Conductor identifying markers. - Conductors shall be tagged near each terminal to identify them with their respective studs or terminals, and the identifying markers shall be W. H. Brady Co., No. B-500 vinyl-cloth with a silicone plastic overcoating; or equal.

(6) Nameplates. - A nameplate shall be mounted on the front of each panelboard. The nameplate material, type B, and engraving shall be in accordance with drawing No. 18 (40-D-6234). The nameplate shall read: "Panel L4 480 VAC distribution."

c. Installation. - The Contractor shall install the panelboard at the location indicated on the drawings. Electrical equipment shall be installed in proper position and shall be completely wired and ready for operation. All cables shall enter the panelboard through conduits.

- d. Painting. - The panelboard shall be painted in accordance with Division 8 (Painting).
- e. Submittals. - Submittals shall be in accordance with this paragraph and paragraph 1.1.4 (Submittal Requirements). The Contractor shall submit the following documentation:

(1) Catalog cut-sheets for the 480 VAC distribution panelboard and corresponding breaker.

(2) Data which includes wiring diagrams, details on internal components (rating, interrupting capability, panel amps, and voltage), and dimensions of each device

- f. Cost.--Cost for furnishing and installing panelboard shall be included in the lump sum price offered in the schedule for furnishing and installing the electrical system.

#### 5.1.5. LIGHTING PANELBOARD

- a. General. - The Contractor shall furnish and install a 120/240-volt lighting panelboard in the location shown on drawing No. 3 (45-301-6575).

The panelboard shall be in accordance with NEMA publication No. PB1, Federal Specification W-P-115A, and as specified.

The panelboard shall be factory assembled and completely installed, connected, and made ready for normal operation. The panelboard shall be rigid, self-supporting, indoor, dustproof type for surface mounting.

The panelboard shall be the air circuit breaker type with incoming main lugs.

The panelboard shall be of the sectional type with interchangeable units permitting the substitution of breakers of larger ratings.

The panelboard will be complete with enclosures, air circuit breakers (bolt-on), terminal blocks, nameplates, mounting materials, and all other required accessories.

Except where indicated on the drawings, the Contractor shall determine the rating of the air circuit breaker thermal protective devices in accordance with equipment requirements and the requirements of NEC, 1996. Also, the Government reserves the right to change the ampere ratings of the thermal protective devices, within the same price group for any breaker, at the time the drawings are submitted for information. Breaker frame sizes shall be as shown on the drawings. Spare breakers shall be furnished as shown on the drawings.

Panelboard schematic diagrams are shown on drawing No. 6 (45-301-6578).

## b. Materials. -

(1) Enclosures. - The enclosure shall have welded joints and shall be galvanized after fabrication. The steel construction of the enclosure shall meet one of the following requirements:

(a) Enclosures with a maximum dimension less than 20 inches shall be constructed of sheet steel not lighter than No. 16 United States Standard gauge.

(b) Enclosures with a maximum dimension more than 20 inches shall be constructed of sheet steel not lighter than No. 20 United States Standard gauge.

Enclosed doors shall be furnished with latch and lock. The locks shall be keyed alike, and two keys shall be furnished for each door.

(2) Air circuit breakers (bolt-on). - The circuit breakers shall be in accordance with NEMA publication No. AB1 and Federal Specification WC-375A.

Each air circuit breaker shall be trip free and shall be furnished with thermal instantaneous overload trip devices. The circuit breakers for 120 - and 240 -volt service shall have an interrupting rating of not less than 10,000 symmetrical amperes.

The circuit breakers shall be single or 2-pole as required, and shall be furnished to supply power for the services as indicated on drawing No. 5 (45-301-6577) and drawing No. 6 (45-301-6578).

(3) Terminal blocks. -

(a) Heavy-duty terminal blocks with barriers shall be furnished and installed for external supply cables.

(b) Terminal blocks for control wiring shall be rated at least 600 volts and 25 amperes, shall be suitable for use with No. 8 AWG wire, shall be molded-block type to accommodate ring lugs 1/2 inch wide (outer diameter) at the terminal screws, shall be furnished with binding-head or washer-head screws having serrated or grooved contact surfaces or having lockwashers, and shall be furnished with molded insulating barriers between terminals. Each terminal block shall have a removable marking strip and cover.

Examples of terminal blocks meeting the above requirements are:

Buchanan catalog No. B104T through B112T Marathon catalog Nos. 1604116 through 1612116 General Electric Co., type EB-25.

(c) Terminal block arrangement and location shall be such that coming and outgoing cables can be supported. Adjacent rows of terminal blocks shall be

separated at least 6 inches edge to edge and at least 6 inches from sides, top, or bottom of the cabinet.

(d) Approximately 25 percent spare terminals shall be provided on each terminal block for terminating spare conductors in each control cable and for possible future use.

(e) Marking strips shall be provided for terminal blocks with conductor designations engraved or printed with a permanent marking fluid. One spare blank marking strip shall be furnished with each terminal block.

(4) Accessory options. --

(a) One interior busbar shall be copper bus 1000 amperes psi.

(b) Equipment ground shall be copper, box bonded.

(5) Conductor identifying markers. - Conductors shall be tagged near each terminal to identify them with their respective studs or terminals, and the identifying markers shall be W. H. Brady Co., No. B-500 vinyl-cloth with a silicone plastic overcoating; or equal, having the following salient characteristics:

(a) Identifying wire markers shall be self-adhesive, vinyl-coated cloth.

(6) Nameplates. - A nameplate shall be mounted on the front of each panelboard. The nameplate material, type B, and engraving shall be in accordance with drawing No. 18 (40-D-6234). The name plate shall read: "Panel L5 120/240 VAC Distribution."

c. Installation. - The Contractor shall install the panelboard at the location indicated on the drawings. Electrical equipment shall be installed in proper position and shall be completely wired and ready for operation. All cables shall enter the panelboard through conduits.

d. Painting. - The panelboard shall be painted in accordance with Division 8 (Painting).

e. Submittals. - Submittals shall be in accordance with this paragraph and paragraph 1.1.4 (Submittal Requirements). The Contractor shall submit the following documentation:

(1) Catalog cut-sheets for the lighting panelboard and corresponding breaker.

(2) Data which includes wiring diagrams, details on internal components (rating, interrupting capability, panel amps, and voltage), and dimensions of each device.

f. Cost.--Cost for furnishing and installing panelboard shall be included in the lump sum price offered in the schedule for furnishing and installing the electrical system.

#### 5.1.6. PAYMENT

Payment for furnishing and installing the electrical system shall be made at the lump sum price offered therefor in the schedule, which price shall include the cost of all labor, materials, equipment and incidentals, required for complete installation of the electrical system as shown on the drawings and herein specified.

#### SECTION 5.2 - GROUNDING SYSTEM

a. General. - The Contractor shall furnish and install all materials required for the complete grounding system for the carpentry/sandblast shop and to connect to the existing grounding system in accordance with NEC, 1996, this paragraph, and the drawings.

b. Submittals. - Submittals shall be in accordance with this paragraph and paragraph 1.1.4 (Submittal Requirements). The Contractor shall submit the following documentation:

(1) Test reports shall be submitted within 15 days after completion of the testing required by subparagraph G. below.

c. Materials. -

(1) Ground cables. -

(a) Copper cables. - The copper cables shall be annealed bare-copper cable, concentric stranded, in accordance with ASTM B 8, class B. The solid wires used in forming the copper cables shall be in accordance with ASTM B 3.

(b) Copper-covered steel cable. - The copper-covered steel cable shall be in accordance with ASTM B 228, 9/16 inch (seven No. 5 AWG), grade 40 HS.

(2) Cable connectors. - Cable connectors shall be of the welded, bolted solderless, or compression type and shall have a current-carrying capacity equal to the cable with which they are to be used. All connectors for ground cables, including fittings, lugs, bolts, nuts, and washers, shall be a copper alloy containing not more than 4 percent zinc. All bolted solderless or compression-type connectors shall meet the requirements of IEEE standard No. 837. Ground connectors that will be buried underground or embedded in concrete shall be listed for direct burial use in accordance with the requirements of UL standard No. 467.

(3) Welding. - All welding shall be performed using Cadweld, Thermoweld, or an equivalent exothermic process. All molds and weld metal shall be from fresh stock and shall be from the same manufacturer. The weld metal and starting material shall contain no significant quantities of hazardous ingredients.

d. Installation. - All equipment, metal conduit, steel structures, shall be connected to the grounding system as shown on drawings No. 5 (45-301-6577). Equipment and/or

miscellaneous metalwork that is required to be grounded, but is not shown on the drawings, shall be connected to the grounding system with a No. 4 AWG ground cable.

e. Connections. -- The Contractor shall make all ground connections between the equipment and the miscellaneous metalwork, and the ground plates of the grounding system whether or not such grounding connections are shown on the drawings. The number of grounding connections for equipment shall be one. Paint, enamel, scale, oil, grease, or other foreign nonconductive material shall be removed from the point of contact on metal surfaces before ground connections are made. After the connections are made, paint or galvanizing on the metal finishes that is damaged or removed as a result of the connections, shall be repaired in accordance with Division 8 (Painting).

Connections of ground cable risers to above-ground equipment shall be fastened above the base plates. The ground cable risers shall be secured to the structures as shown on the drawings.

Ground connections that will be buried underground or embedded in concrete shall be made utilizing an exothermic process. All connections shall be performed in accordance with manufacturer's instructions.

f. Damaged ground cable. - Existing ground cables, shown on drawing No. 2 (45-301-6574) are shown only in approximate location, and caution should be used in excavating near existing ground cables. The Contractor shall repair all ground cable damaged during construction to the satisfaction of the Contracting Officer at no additional cost to the Government.

g. Testing. - The resistance of the interconnected carpentry/sandblast shop, transformer T5, and the existing warehouse area ground mat to ground shall be measured no sooner than 30 days after completion of the substructure concrete pouring. The resistance shall be measured by the Contractor using the fall of potential method described in section 8.2.1.5 of IEEE standard No. 81, dated May 1983, using a Megger Ground Tester of the heavy-duty, low-resistance type with direct-reading, direct-current ohmmeter as described in bulletin No. 25 and any one of bulletins Nos. 25J, 25J-2, and 25T, all by James G. Biddle Co.; or equal.

When performing the test, the initial distance between the remote current electrode and the ground mat under test shall be a distance of at least six times the longest diagonal dimension of the ground mat being measured, and the distance between the potential electrode and the mat shall be a distance of at least four times the longest diagonal dimension of the mat. These distances should provide a starting point outside the area of influence of the ground mat to begin taking test measurements. The potential electrode shall be located as nearly as possible in an opposite direction from the current electrode during testing. The exact locations of the electrodes for subsequent measurements shall be determined by the Contractor in order to obtain results that reflect the actual resistance of the ground mat. The Contractor shall notify the Contracting Officer at least 24 hours in advance of the time the test is to be performed in order that the test may be witnessed by a representative of the Contracting Officer.

g. Payment. -- Payment for the complete electrical ground system will be made at the lump-sum price offered therefor in the schedule, which price shall include the cost of furnishing and installing all materials and testing.

## SECTION 5.3 - TRANSFORMERS

### 5.3.1. DRY-TYPE TRANSFORMERS

a. General. - The Contractor shall furnish and install one 3 phase, 500 kilovolt ampere, 2400/480 volt dry-type pad-mounted transformers (designated T5) and one single phase 100 kilovolt ampere, 120/240 volt dry-type pad-mounted transformer (designated T4) in accordance with this paragraph and where shown on the drawings.

Except as specified, characteristics, definitions, terminology, voltage designations, and tests shall be in accordance with the following ANSI Requirements, Terminology, and Test Code for Distribution, Power, and Regulating Transformers:

- (1) General Requirements, C57.12.00.
- (2) Terminal Markings and Connections, C57.12.70.
- (3) Terminology, C57.12.80.
- (4) Test Code, C57.12.90.

b. Submittals. - Submittals shall be in accordance with this paragraph, paragraph 1.1.4 (Submittal Requirements). The Contractor shall be responsible for the accuracy of all submittals.

The Contractor shall submit, for approval:

- (1) Equipment layout drawings, manufacturer's data, and bills of material for each item or component of equipment.
- (2) Results of factory testing required by subparagraph e. below.

c. Materials. -

- (1) Transformer T5 shall have the following ratings and features:

Type.....3 phase, 60 hertz  
outdoor, dry-type

Capacity.....500 kVA

High-voltage rating.....2400 volt delta connected

Low-voltage rating.....480/277 volts grounded wye

Basic impulse insulation level.....30 kilovolts (high side)  
1.2 Kv (low side)

Taps, rated kilovolt ampere capacity..  $\pm 2 \frac{1}{2} \%$ ,  $\pm 5\%$ ,  $-7 \frac{1}{2}\%$ ,  $-10\%$

Impedance.....6.5 percent

Temperature rise..... 150°C

The transformers shall be capable of operating at specified loading and temperature rises when installed in the following ambient temperatures:

Average ambient temperature for 24 hours .....185°C insulation class

(2) Transformer T4 shall have the following ratings and features:

Type.....1 phase, 60 hertz  
outdoor, dry-type

Capacity.....100 kVA

High-voltage rating.....240/480 volt

Low-voltage rating.....120/240

Basic impulse insulation level.....1.2 kilovolts (high side)

Taps, rated kilovolt ampere capacity..  $\pm 2 \frac{1}{2} \%$ ,  $\pm 5\%$ ,  $-7 \frac{1}{2}\%$ ,  $-10\%$

Impedance.....5.2 percent

Temperature rise.....150°C

The transformer shall be capable of operating at specified loading and temperature rises when installed in the following ambient temperatures:

Average ambient temperature for 24 hours 185 °C insulation class

(3) The transformers shall be provided with those accessories specified in ANSI C57.12.01 and C57.12.50.

(4) Transformer T5 shall consist of high and low-voltage cable terminating compartments. There shall be no exposed screws, bolts, or other fastening devices which are externally removable, nor shall there be openings through which foreign objects such as sticks, rods, or wires might contact live parts. Compartment doors shall be provided with means of padlocking. Construction shall limit entry of water (other than floodwater) into compartment to prevent impairment of operation of transformer. The enclosure shall be dry-type, NEMA dR outdoor, general purpose, pad-mounted.

(5) Transformer T5 shall have Incoming and outgoing terminal compartments with hinged doors with provisions for latching in open position and shall be located side by side separated by steel barrier with incoming compartment on the left. High-voltage (incoming) compartment shall be accessible only after door to low-voltage (outgoing) compartment has been opened. To facilitate making connections and permit cable pulling, doors and compartment hood shall be removable. Removable doorsill on compartments shall be provided to permit rolling or skidding of unit into place over conduit studs in foundation.

(6) Transformer T5 primary load-break fused disconnect switch assembly. -- Paragraph 5.3.2.

(7) Transformer T5 secondary manually operated load-break disconnect switch. -- Paragraph 5.3.3.

(8) Grounding. - Grounding shall be in accordance with Section 5.2 (Grounding), and as shown on the drawings. There shall be provisions for grounding in both high- and low-voltage compartments in transformer T5 as well as in transformer T4. The contractor shall provide solderless, clamp-type lugs or terminals for connecting to ground cables.

(9) Special tools and accessories required for installation, normal operation, and maintenance of equipment shall be furnished by the Contractor.

(10) Nameplates. - A nameplate shall be mounted on the front of each transformer. The nameplate material, type B, and engraving shall be in accordance with drawing No. 18 (40-D-6234).

d. Installation. - The transformers shall be installed in the locations shown on the drawings.

e. Testing. - The transformers shall receive factory tests described in ANSI C57.12.90, except no-load-loss and exciting-current tests will not be required.

f. Painting. - The transformers shall be painted in accordance with Section 8.1 (Painting).

g. Cost. - Cost for furnishing and installing two dry-type pad-mounted transformers shall be included in the lump-sum price offered therefor in the schedule for furnishing and installing power cable and transformers.

### 5.3.2. LOAD BREAK FUSED DISCONNECT SWITCH ASSEMBLY

a. General. -- The Contractor shall furnish and install two sets of disconnect switch assemblies.

(1) The disconnect in the relay building shall consist of a heavy duty industrial type, 3-pole, single-throw load break disconnect switch with fuses. This disconnect shall be rated for indoors

(2) The disconnect on the primary side of the 2400/480 volt transformer (T5) shall consist of an enclosure, attached to or included with the transformer enclosure, containing heavy duty industrial type, 3-pole, single-throw load break disconnect switch with fuses.

Each assembly shall be in accordance with drawings No. 9 (45-301-5216), and the applicable parts of ANSI C37, NEMA publication No. SG2 and the following paragraphs:

b. Materials. -

(1) Two load break disconnect switch assemblies, each having the following ratings and features and in accordance with NEMA publication No. KS1:

Features.....Three pole, single throw switches,  
two of which are key interlocked

System nominal voltage ratings.....2,400 volts

Continuous current ratings.....120 amperes

Mounting position.....Vertical

Fuse mounting rating.....4.3 kv

(2) Fuse units.-- Each disconnect switch assembly shall be furnished complete with one fuse unit per pole and one spare fuse unit. Each fuse unit shall be of a type that can be re-used readily in the field by means of fuse-link assembly which can be inserted in the expulsion tube.

System nominal voltage.....2,400 volts

Interrupting rating.....50,000 amperes  
symmetrical

Approximate E rating 100 amperes.

- (3) Fuse assembly. -- Each fuse assembly must be capable of interrupting the rated interrupting current or of limiting the fault current through the fuse to a value which the fuse unit can interrupt.
- (4) Fuse remover. -- Two fuse removers shall be furnished.
- (5) Switchgear enclosure. - The switchgear enclosure, attached to or included with the transformer enclosure, shall be provided with doors having fully concealed hinges. The door shall be equipped with padlockable lever handles. The enclosure shall be grounded to the existing grounding system, shown on drawing No. 5 (45-301-6577), with No. 4/0 AWG stranded copper cable.
- c. Exposed ferrous metal parts. -- Any exposed ferrous metal parts of the disconnect switch assembly and fuses shall be galvanized.
- d. Painting. - The disconnect switch assembly shall be painted in accordance with Section 8 (painting).
- e. Drawings. - The Contractor shall furnish drawings and data in accordance with paragraph 1.1.4 (Submittals).
- f. Installation. - The disconnect switch assemblies shall be installed in the locations shown on the drawings.
- g. Submittals. - The contractor shall furnish the following:
  - (1) Approval drawings and data. --
    - (a) Equipment layout drawings showing the location of equipment devices, components, bus, and other features in their relative physical locations.
    - (b) Bill of material providing information on manufacturer, style, rating, quantity, and other identifying information for each item or component of the equipment.
    - (c) Nameplate lists providing information on material, sizes, and engraved lettering.
    - (d) Schematic diagram drawings showing complete functional operation of the equipment including equipment devices and components that are identifiable by reference to the bill of material item.
    - (e) Wiring diagram drawings showing complete wiring of the equipment devices and components including terminal numbers and wire (conductor) designations.
    - (f) Manufacturer's data, such as catalog cut sheets, shall include the manufacture's name and address and comprehensive product information including catalog number, type, model, electrical ratings, dimensions, specifications, fuse unit time-

current curves (if applicable), fault current rating, interrupting rating, and installation and operation details. Where several items are listed on the same data sheet, the data pertinent to the equipment which are being submitted for approval shall be clearly marked. The data shall fully demonstrate that the material or equipment proposed meet the requirement of these specifications. Manufacturer's catalog data shall be furnished in a looseleaf binder or folder.

(1) Wiring devices. -- Approval data on wiring devices shall include data on cover plates.

(2) After receipt of the fuse unit time-current curves (if applicable) Reclamation shall provide the exact rating from the load-break fused disconnect switch assemblies.

(3) After receipt of the submittal, Reclamation shall provide the exact momentary current of the manually operated load-break disconnect switches.

(g) Fused disconnect enclosure and load-break disconnect enclosure data shall include type of enclosure, required mounting materials, layout illustrating the enclosure as separate from or included with transformer T5 enclosure, and verification that the enclosure(s) are rated for outdoors; NEMA 3R or 4.

(2) Operation and maintenance manuals, descriptive data, and bill of materials. Each set of this data shall be assembled into one enclosing cover.

The instruction book shall include:

(a) An index sheet at the front of each book which provides page or index tab number information for each item.

(b) Manufacturer's instructions, operation, and catalog data sheets for each device and component.

(c) A list of recommended spare parts and components.

(d) Circuit breaker and fuse time-current curves.

(e) Complete parts lists for all replacement parts.

(f) Schematic diagrams.

(g) Wiring diagrams.

h. Cost. -- Cost for furnishing and installing two manually group-operated load break metal-enclosed disconnect switch assemblies shall be included in the lump-sum price offered in the

schedule for furnishing and installing power cable and transformers, which price shall include the cost of furnishing and installing all materials for the disconnect switch assemblies.

### 5.3.3. MANUALLY OPERATED LOAD-BREAK DISCONNECT SWITCH

a. General. - The Contractor shall furnish and install three sets of disconnect switch assemblies for transformer T5 for future use. The switch assemblies shall be located in one enclosure or be a part of the secondary side of transformer T5. Each disconnect shall be manually operated. The three disconnect switch configuration shall be in accordance with the drawings.

b. Materials. --

(1) Disconnect switch. -- The disconnect switches shall meet the requirements of ANSI C37.32 and shall have the following ratings and features:

Type.....3-pole, single throw outdoor type,  
gang-operated.

System nominal voltage.....480 volts

Basic impulse level (BIL).....15 kilovolts

Continuous current.....600 amperes

Momentary current.....6,000 amperes

d. Painting. - The disconnect switch assembly shall be painted in accordance with Division 8 (painting).

e. Drawings. - The Contractor shall furnish drawings and data in accordance with paragraph 1.1.4 (Submittals).

f. Installation. - The disconnect switch assemblies shall be installed in the locations shown on the drawings.

g. Submittals. -- Paragraph 5.3.2g.

h. Cost. -- Cost for furnishing and installing metal-enclosed, 480 volt, 3-pole, manually group-operated disconnect switch assemblies shall be included in the lump-sum price offered in the schedule for furnishing and installing power cable and transformers, which price shall include the cost of furnishing and installing all materials for the disconnect switch assemblies.

## SECTION 5.4 - FURNISHING AND INSTALLING POWER CABLE

### 5.4.1. FURNISHING AND INSTALLING POWER CABLE

a. General. -- The Contractor shall furnish all materials and equipment necessary for installing power cable between the carpentry/sandblast shop and the switchyard relay house in accordance with these paragraphs and as shown on the drawings.

This work includes:

- (1) Furnishing and installing power cable, in 4" conduit, between transformer T4 and transformer T5.
- (2) Modifying the existing conduit in the warehouse yard as shown on drawing No. 2 (45-301-6574).
- (2) Furnishing and installing power cable in the existing conduit between transformer T5 and the switchyard relay house.
- (3) Core drilling one hole in the wall of the existing relay house.
- (4) Making final connections of the power cable to transformers T4 and T5, shown on drawing No. 2 (45-301-6574) and drawing No. 3 (45-301-6575), to the bus bar in the existing switchyard relay house, shown on drawing No. 12 (45-D-8494) and to the 480-volt distribution panel.

b. Materials. -- The materials for installing power cable shall conform to the following requirements:

- (1) Power cable. -- Transformer to 120/240 volt distribution panel and 480 volt distribution panel Transformer T5:
  - (a) Single-conductor, nonshielded type, minimum conductor size shall be 350 MCM copper.
  - (b) UL listed and shall bear the UL-type label on the outer surface in accordance with NEC, 1996.
- (2) Power cable. -- 480 volt distribution panel to Transformer T4:
  - (a) Single-conductor, nonshielded type, minimum conductor size shall be 2/0 AWG copper.
  - (b) UL listed and shall bear the UL-type label on the outer surface in accordance with NEC, 1996.

- (3) Power cable. -- Transformer T5 to relay house
  - (a) Single- conductor, nonshielded type, minimum conductor size shall be 3/0 AWG copper with concentric ground, 15 kv insulated.
  - (b) UL listed and shall bear the UL-type label on the outer surface per NEC, 1996.
- (4) Conduit. -- Paragraph 5.1.1.
- (5) Dry-type transformers. -- Paragraph 5.3.1.

c. Installation. -- The power cable shall be installed as shown on the drawings and in accordance with the applicable requirements of the NEC, 1996 and NFPA-101, 1997.

Making electrical connections shall include furnishing all materials to make the connections and shall be made in accordance with the following:

- (1) Clean the contact surfaces immediately prior to making the connection to remove dirt deposits and any old joint compound.
  - (a) Prepare tinned contact surfaces by rubbing with fine steel wool.
  - (b) Prepare untinned contact surfaces by cleaning to bright metal with emery cloth. Remove nicks and ridges by filing. Wipe off all copper particles.
- (2) Coat the contact surfaces with a "nongrit" joint compound such as NO-OX-ID "A-Special."
- (3) Do not abrade the copper contact surfaces through the joint compound.
- (4) Bolt the bus connection in accordance with the following:
  - (a) Lubricate bolts with a nongrit joint compound such as NO-OX-ID or Alcoa No. 2 EJC.
  - (b) Torque all bolts in accordance with manufacturer's instruction.
  - (c) Remove excess joint compound except a small bead around the joint to prevent entrance of moisture and dirt.

d. Core Drilling.-- The contractor shall core drill one hole in the existing reinforced concrete wall of the relay house as indicated on specification drawing No. 11 (45-D-8494). The core hole shall be larger in diameter than the outside diameter of the 4" conduit to be installed. Core drilling shall be the only acceptable method for cutting through the wall for installation of conduit. Upon completion of the hole, the Contractor shall thoroughly clean up all cuttings or other waste materials resulting from the core drilling operations in accordance Paragraph 1.5.6

(Cleanup and Disposal of Waste Materials). If drilling water is used, surfaces of concrete to remain exposed shall be cleaned immediately so as to prevent discoloration of the concrete by the drilling water and cuttings. The Contractor shall take all necessary precautions required to contain drilling fluids and prevent them from leaking to lower floors or otherwise becoming a nuisance or hazard

e. Fire Retardant Sealant.-- Where the conduit is installed through the existing concrete wall, the Contractor shall seal the annular space between the conduit and the perimeter of the core hole with fire retardant sealant. The sealant shall be placed in accordance with manufacturer's instructions.

g. Cost. -- The cost for furnishing all materials, installing cable, core drilling, installing sealant, and making all power connections for the power cable will be made at the applicable lump sum price for furnishing and installing power cable and transformers.

#### 5.4.2. PAYMENT

Payment for furnishing and installing power cable and transformers shall be included in the lump sum price offered therefor in the schedule, which price shall include the cost of all labor, materials, equipment and incidentals, required for complete installation of the power cable and transformers, as shown on the drawings and herein specified

## DIVISION 6--MECHANICAL

## SECTION 6.1 - AIR COMPRESSOR UNIT AND PIPING

## 6.1.1. AIR COMPRESSOR UNIT - AIR COOLED

a. General. - The Contractor shall furnish, install, service, and test the motor-driven air compressor unit in accordance with these specifications. The compressor shall be installed in the shop in the location shown on drawing No. 3 (45-301-6575). The Contractor shall furnish the unit complete with motor, controls, accessories, appurtenances, special wrenches, and tools.

The compressor shall have a capacity of not less than 100 cubic feet of free air per minute delivered at a nominal gauge pressure of 100 pounds per square inch while operating at an elevation of 1580 feet above sea level.

b. Materials. -

(1) Air compressor. -

(a) Type and description. - The air compressor shall be of the two-stage, air-cooled type for stationary service and shall be provided with air-cooled intercoolers. The air compressor shall be capable of continuous operation at the specified discharge pressure and capacity without overheating. At least 20 days prior to purchase of the air compressor, the contractor shall submit manufacturer's data which indicate that the air compressor meets the requirements of this paragraph. Approval will be granted only on the latest models currently in production and which have demonstrated that they will perform satisfactorily.

All parts shall be made accurately to American Standard gauge so as to facilitate replacement and repairs. The frame shall completely enclose the working parts and shall be provided with flanged bases for bolting to a baseplate as described below. The compressor shall be provided with a splash or forced-feed lubrication system for adequate lubrication of all bearings and reciprocating parts. The bearings shall be of the removable-sleeve, roller, or ball type. The moving parts of the cylinder discharge air valve shall be made of high-grade steel, heat treated, tempered, and ground; shall be designed to have large effective area, long life, and high mechanical efficiency; and shall be quiet in operation.

(b) Drive. - The air compressor shall be supplied with a suitable V-belt drive, correctly designed to produce smooth operation. The V-belt shall be of adequate size to drive the compressor with a service factor of not less than 1.25. The motor and compressor pulleys shall be of cast iron or steel with accurately turned grooves and shall be securely keyed to the shafts. The drive shall be provided with guards which totally enclose these parts.

- (c) Baseplate. - The air compressor and motor shall be mounted on a common rigid cast-iron or structural-steel baseplate. The baseplate shall be suitable for anchoring to a concrete foundation and shall be designed to suit the unit furnished. Shims or spacers if used under the compressor or motor base shall not exceed 1/2 inch in overall thickness.
- (2) Motor. - The motor furnished shall be rated at 480 volts, 3 phase.
- (3) Controls. - The following control equipment shall be furnished and installed and shall conform to the requirements of NEMA Standards for Industrial Controls:
  - (a) Control devices. - The control devices shall allow the compressor motor to start and stop unloaded when operating intermittently in the automatic mode and shall load and unload the compressor when operating continuously in the manual mode as determined by the setting of the "MANUAL-OFF-AUTO" selector switch on the motor starter.

If a magnetic unloader is furnished, it shall be suitable for use on a 115-volt, 60-hertz control circuit. The pressure-regulating switch shall be of the standard type, adjustable within an operating range of 80 to 110 percent of the pressure rating of its compressor. The control equipment shall conform to all the applicable standards of IEEE and NEMA Manufacturers Association. The control devices shall be suitable for wall mounting adjacent to the starter cabinet.
- (4) Accessories. -
  - (a) Air check valve. - The air check valve shall be a "Depend-A-Check" valve as manufactured by the Hoerbiger Corporation of America, Fort Lauderdale, Florida, or equal, having the characteristics specified in this subparagraph. The valve disks and springs shall be constructed of stainless steel and shall have a pressure rating not less than the discharge pressure of the air compressor with which it is to be used, shall be specifically designed for air service, equal in size to the air compressor discharge, and for installation in the air discharge line.
  - (b) Elapsed-time meter. - An elapsed-time meter shall be furnished and installed.
  - (c) Combination air intake filter and silencer. - Shall be of the dry type. The filter shall have disposable elements and shall have a micron rating as recommended by the air compressor manufacturer.
  - (d) If the compressor discharge has a blowoff for unloading the compressor, a silencer shall be furnished to keep the air discharge noise level within limits.
  - (e) Start-up kit. -- Furnish and install a complete start-up kit.

(5) Appurtenances. - There shall be furnished and installed with the air compressor units all bolts, studs, lubricating devices, gaskets, and all other appurtenances that may be required to make the unit complete and ready for operation.

(6) Wrenches and tools. - There shall be furnished with the air compressor unit one set of special wrenches and special tools required for complete assembly and disassembly of the air compressor and motor. The Contractor shall furnish a complete list of wrenches, tools, and accessories being furnished.

(7) Shut-off valves. -- Energy isolating and lockout type meeting OSHA Standard 1910-147. Two-piece brass body construction with reinforced PTFE seats, chrome plated ball, and full port design.

(8) Piping. -- Schedule 40, seamless, black carbon steel, conforming to ASTM A 106, Grade B, and ASME B36.11.

c. Preparation for shipment. - The pipe connections on all equipment shall be covered for protection and to prevent the entrance of foreign matter during shipment and while awaiting installation. During shipment, pipe connections may be closed with wood flange covers, pipe plugs, or other suitable means.

d. Installation. - The air compressor unit shall be completely assembled and matchmarked to ensure correct fitting of all parts in the manufacturer's shop and disassembled only as necessary for shipment. The Contractor shall clean, reassemble, align, shim, and anchor the air compressor unit in its final position in accordance with the manufacturer's installation instructions and as shown on the drawings. Installation shall include the control and unloading devices and installing the motor-starters on the concrete walls. The Contractor shall connect the air compressor unit to the piping system and shall make all gauge and electrical connections to the compressor, motor starter, and control panel. After the air compressor unit, associated piping, and control equipment have been installed, the unit shall be serviced and tested as provided in subparagraph e. below.

e. Testing. - The air compressor shall be tested by the Contractor in accordance with manufacturer's operating instruction to determine that it operates properly. The test shall also include a complete check of the control system for correct operation and a noise level test.

The compressor shall be operated without load for a period of not less than 1 hour and then shut down. During the operation and after shutdown, careful observation shall be made to determine that all parts are in proper alignment, are receiving correct lubrication, and that no undue heating, as recommended by the manufacturer, exists.

The compressor shall be restarted, and the load gradually increased by slowly building up the discharge pressure until maximum normal operating pressure is reached and shall be operated at this pressure for a period of not less than 1 hour and then shut down. During the operation and after shutdown, careful observation shall be made to determine that all parts are in proper alignment, are receiving correct lubrication, and that no undue heating exists.

During the running-in period, the control system shall be tested and necessary adjustments shall be made as required to ensure proper operation of the compressor. Any wiring or equipment damaged during installation or in the checkout process shall be repaired or replaced and at the Contractor's expense. The control devices shall also be set to start the compressor at 90 pounds per square inch and to stop the compressor at 105 pounds per square inch when operating under startstop (AUTO) control. Without additional cost to the Government, any necessary adjustments shall be made by the Contractor until the operation of the unit is approved by the Contracting Officer.

f. Submittals. -- At least 20 days prior to purchasing the air compressor the contractor shall submit manufacturers catalog sheets and data showing that the air compressor chosen meets all of the requirements of these specifications.

g. Payment. -- Payment for furnishing and installing the motor-driven air compressor unit will be made at the lump-sum price offered therefor in the schedule for furnishing and installing the air compressor.

## SECTION 6.2 - INSTALLATION OF FILTER EQUIPMENT

### 6.2.1. INSTALLATION OF FILTER EQUIPMENT

a. General. --The contractor shall assemble, install, test, and paint the Government-furnished pulse filter system.

b. Materials. --

(1) Upon written notification by the Contractor, the Government will provide the following materials at the jobsite:

- (a) Bag house (partially assembled)
- (b) Fan and motor assembly
- (c) Controls and gages

(2) The contractor shall provide all necessary materials to complete the assembly of and install the pulse filter system including but not limited to the following materials:

- (a) Anchor bolts for mounting the equipment.
- (b) Duct work and accessories, as shown on the drawings and provided in Paragraph 6.2.2.
- (c) Hardware necessary for mounting controls and gages including pneumatic tubing.

- (d) Foundation, as shown on the drawings and provided in Paragraph 3.1.1.
- (e) Conduit and wiring, as shown on the drawings and provided in Paragraph 5.1.1.
- (f) Painting of the bag house and fan assembly, as provided in Division 8 (Painting).

c. Assembly and installation.--The contractor shall completely install the entire pulse filter system according to the drawings, these specifications, and the assembly and instruction manuals for the various pieces of equipment as provided by the Government. The contractor shall disassemble, clean, and reassemble the piping system of the bag house. Damaged or defective materials shall not be installed. The repair of damage which is due to the operations of the Contractor shall be made by the Contractor without additional cost to the Government. After the filter system has been assembled and installed, the entire system shall be serviced and tested as provided in subparagraph e below. Installation manuals and instructions are included in Appendix A.

d. Painting.--After installation and testing of the pulse filter system the contractor shall paint all exterior portions of the filter system as provided in Division 8 (Painting).

e. Testing.--The completed pulse filter system shall be tested by the Contractor in accordance with the manufacturer's operating instructions to determine that it operates properly. The test shall also include a complete check of the control system for correct operation.

f. Submittals.--The contractor shall submit paint chips of the colors the contractor proposes to use for the pulse filter system to the Government for approval.

g. Payment.--Payment for assembling, installing, testing, and painting the pulse filter system will be made at the lump sum price offered therefor in the schedule for assembling, installing, testing, and painting the Government-furnished pulse filter system.

#### 6.2.2. DUCTWORK

a. General. - The ductwork shall include ducts, transition sections, reducers, and control dampers as shown on the drawings and shall be complete with all accessories required for installation and operation. Ductwork is required for the pulse filter system, air-conditioner, and evaporative cooler.

b. Materials. -

- (1) Steel sheets. - Federal Specification QQ-S-775E, type 1, class D, minimum No. 11 United States Standard gauge, zinc-coated sheets. Ductwork shall be constructed from galvanized steel sheets of not less than No. 22 United States Standard gauge.

(2) Circular ducts. -- Circular ductwork shall be galvanized of not less than No. 26 United States Standard gauge for spiral seam and not less than No. 24 United States Standard gauge for longitudinal seam.

(3) Structural steel. - ASTM A 36.

(4) Sealing tape. -- 3M Scotch Tape No. 474 by Minnesota Mining and Manufacturing Company; or equal, having the following salient characteristics:

(a) Tape shall be woven fiber, impregnated with a mineral gypsum compound.

(5) Control dampers. -- Manually-operated control dampers shall be furnished complete with frame, blades, pivots, bearings, and linkages. Damper blades shall be a maximum of 2 inches wide, shall interlock with adjacent blades, shall be constructed from galvanized steel of not lighter than No. 16 United States Standard gauge, and shall be mounted on corrosion-resistant pivots set in permanently lubricated or porous bronze bearings. The blades shall be reinforced by forming or crimping and shall be linked together to operate as a unit. Closed-cell edging seals shall be provided at the point of overlapping between adjacent blades.

Damper frames shall be constructed from galvanized steel of not lighter than No. 16 United States Standard gauge and shall have low-friction side seals to prevent air leakage. The side seals shall not interfere with the damper operation. Dampers and seals shall be rated for operation from 30° to 120°F.

c. Installation. - All joints shall be smooth and tight and shall be lapped in the direction of airflow.

Ductwork shall be supported sufficiently to prevent sagging, distortion, and vibration. Duct hangers shall be suspended from structural-steel shapes as shown on the drawings.

g. Cost. --Cost for furnishing and installing ductwork and control dampers will be made at the lump-sum price offered therefor in the schedule for assembling, installing, and testing the Government-furnished pulse filter system.

### SECTION 6.3 - EVAPORATIVE COOLER

a. General. -- The Contractor shall furnish and install one factory-assembled direct type evaporative cooling unit complete with casing, aluminum or stainless steel double deflection discharge register, centrifugal fan, filters, motor, control panel, motor controller, relays, switches, piping, valves, direct evaporative cooling recirculating pump, humidifying elements, water pump, water-distribution system, water reservoir, float valve, overflow pipe, automatic bleed-off, makeup water connection, wall mounted thermostat, ductwork and all other accessories required for a complete operating system.

The Contractor shall also furnish and install all conduit, and power and control wiring necessary to make the evaporative cooling unit ready for operation.

The evaporative cooler shall be designed for outdoor installation on a concrete slab as shown on drawing No. 3 (45-301-6575).

The evaporative cooling unit shall be capable of cooling 4,200 cubic feet per minute of outdoor air entering at 108°F dry bulb / 66 °F wet bulb to a leaving air temperature of 75 °F dry bulb. The unit shall be capable of delivering the specified airflow, free airflow, plus the static pressure required for all components internal to the evaporative cooling unit. The unit shall have a minimum saturation effectiveness of 80 percent at 500 feet per minute airflow velocity through the evaporative media.

b. Submittals. -- Submittals shall be in accordance with this paragraph and paragraph 1.1.4 (Submittal Requirements). The following shall be submitted:

(1) Approval drawings and data. -- Commercial products data including manufacturer's performance tables or curves showing rated capacities; saturation effectiveness; correction factors for altitude, temperature and voltage; dimensions, weights, application, construction materials, accessories, required clearances; electrical requirements, wiring diagrams and bill of materials.

(2) Final material. -- Service manuals including installation, operation and maintenance instructions, and copies of all previously approved data.

c. Materials. -

(1) Casing. -- Design for draw-through air-flow with (horizontal, vertical) discharge fan as shown on the drawings. Provide removable type access doors with gasket seals and quick release fasteners with hinges. Construct casing from double wall No. 18 U.S. Standard gauge hot-dipped galvanized steel panels and interior components from hot-dipped galvanized or noncorrosive materials. Panels shall be insulated with 1-1/2 lb density neoprene coated fiberglass. Fabricate metal parts from stainless steel when in direct contact with wetted media or covered with water. Coat with weather-resistant, baked-enamel. Provide a 3/4-inch drain.

(2) Base pan. -- Entire bottom of cooler casing shall be a watertight base pan with integral inlet water supply and drain connections. Construct base pan from No. 16 U.S. Standard gauge stainless steel. The base pan seams, joints, and fittings shall be welded to be leaktight.

(3) Fan and drive. -- The fan shall be the centrifugal type with forward curve fan blades. The fan outlet velocity shall not exceed 1,600 feet per minute. The centrifugal fan shall be furnished with grease-lubricated ball bearings and lubricating fittings. Equip with a V-belt drive adequately sized to drive the fan with an overload factor of 1.6. Provide fan

and motor with cast iron or steel sheaves with accurately turned grooves keyed to shafts. Motor sheaves shall be adjustable. Provide a fan guard.

Provide a flow switch to de-energize fan motor if belts break.

Provide a rigidly braced steel housing constructed from gauges recommended by AMCA and a supporting frame common to fan and motor. Mount on vibration isolators.

(4) Motor. -- NEMA MG1, across-the-line, full-voltage-starting, induction type, suitable for continuous operation, and with a nameplate horsepower rating a minimum of 115 percent of brake horsepower required at specified performance requirements. Maximum motor speed: 1,800 revolutions per minute.

Provide internal thermal protection.

(5) Internal water distribution system. -- Piping shall be ASTM B88 Type K copper tubing. Fittings shall be wrought or cast copper or brass, solder-joint pressure fittings. Piping shall be arranged to assure equal water distribution to humidifying elements.

(6) Float valve. -- Brass, bronze, or stainless steel valve with copper or PVC pipe float.

(7) Humidifying elements. -- Media shall be CELdek by Munters Evaporative Cooling Division, 108 Sixth Street Southeast, Fort Meyers FL 33907: or equal, having the following salient characteristics:

(a) Rigid, cross-fluted fiberglass media chemically treated to prevent rotting.

(b) Eight inches thick and shall provide a minimum saturation effectiveness of 80 per cent at an air velocity of 500 feet per minute.

Provide stainless steel frame suitable for servicing and for fastening element securely in place.

(8) Air filter. -- Air filters shall be medium efficiency disposable type.

(9) External water supply piping. -- Piping shall be ASTM B88 Type K copper tubing. Fittings shall be wrought or cast copper or brass, solder-joint pressure fittings.

(10) Electrical requirements. -- Evaporative cooling units shall be prewired for 120 volt, single-phase, 60-hertz service. Electrical panels shall include NEMA motor starters, pump relays, fuses and fuse blocks, terminal blocks and controls for single point electrical and control connections. All wiring shall terminate in one electrical panel for each factory assembled evaporative cooling unit.

Provide disconnect switch and exterior mounted 120-volt control transformer.

(11) Shut-off valve. -- 3/4" Commercial gate valve, bronze body, wedge, and screw-in bonnet. Non-rising stem.

d. Installation. -- Install in accordance with Uniform Building Code, Uniform Mechanical Code, National Electric Code, state, local code requirements, and the equipment manufacturer's recommendations. Provide flexible connector between the fan discharge and ductwork or building connection as applicable. Align, level, and securely anchor in place. Identify with plastic nameplate. Close off and seal joints and spaces between evaporative cooler support frames and structure to prevent air leakage.

e. Testing. -- Upon complete installation the evaporative cooling unit shall be tested with the propeller fans and the bag house filters for a minimum of 8 hours to insure proper operation.

f. Cost. -- The cost of furnishing and installing the evaporative cooling unit shall be included in the lump-sum price offered in the schedule for furnishing and erecting the pre-engineered metal building

#### SECTION 6.4 - PROPELLER FANS

a. General. -- The Contractor shall furnish and install propeller-type exhaust fans complete with back-draft dampers, fan blades, motor with V-belt drive, wall mounted fan housing and motor guard, motor support bracket, weather hood, adapter plates as required, and all accessories required for installation and operation. The fan in sandblast shop will be connected to operate with the evaporative cooler. The fan in the carpentry shop will controlled by a separate switch.

b. Submittals. -- Submittals shall be in accordance with this paragraph and paragraph 1.4.1(Submittal Requirements). The following shall be submitted:

(1) Approval drawings and data. -- Commercial products data including manufacturer's performance tables or curves showing rated capacities, correction factors, dimensions, weights, application, construction materials, accessories, required clearances, and electrical requirements.

(2) Final material. -- Service manuals including installation, operation and maintenance instructions, and copies of all previously approved data.

c. Materials. -

(1) The exhaust fans shall be suitable for mounting as shown on the drawings and shall be rated to deliver 4,200 cubic-feet-per-minute airflow.

(2) Fan and drive. -- The propeller fan shall be the heavy-duty type with back-draft damper, fabricated steel propeller-type blade, and shall be equipped with a V-belt drive. The V-belt shall be adequately sized to drive the fan with an overload factor of 1.6 and

shall have adjustable motor sheaves. The fans shall be provided with fan guard and wall mounted housing.

(3) Motors. -- The fan motor shall be the across-the-line, full-voltage-starting, constant-speed, induction type suitable for continuous operation and shall conform to the applicable standards of IEEE, NEMA, and ANSI. Fan motor speeds shall be full speed and half speed.

The horsepower nameplate rating for the fan motor shall be not less than 115 percent of the brake horsepower required at the specified performance. The fan motor shall be rated at 120 volts, single phase, 60 hertz. Based on an ambient temperature of 25 °C, the temperature rise rating for the type motor enclosure and insulation class shall not exceed the temperature rise listed in the latest NEMA Standards for Tests and Performance of Motors.

(4) Wall mount fan housing. -- Factory assembled heavy gauge galvanized steel with prepunched holes.

(5) Exhaust fan switch.-- Exhaust fan switch, designated S7, on drawing No. 5 (45-301-6577):

(a) Manufacturer.--The switch shall be as manufactured by Pass & Seymour, Syracuse NY 13221; Hubbell Inc., Bridgeport CT 06605; Challenger Circle F, Inc., P.O. Box 591, Trenton NJ 08604; or equal, having the following salient characteristics:

(aa) Description.--The switch shall be NEMA WD 1, heavy-duty, AC only, general use snap switch, ivory type with an impact resistant plastic toggle handle.

(bb) Wiring terminals.--Screw type terminals only shall be provided for wiring. A screw terminal shall be provided for grounding.

(cc) Voltage rating.--The voltage rating shall be 120/277 volts, alternating current.

(dd) Current rating.--The current rating shall be 20 amperes.

(5) Weatherhood. -- Weatherhood shall be heavy gauge galvanized steel with prepunched holes and 2 by 2 by 0.063 galvanized mesh bird screen.

d. Installation. -- The propeller fans shall be installed as shown on the drawings and in accordance with Uniform Building Code, Uniform Mechanical Code, National Electric Code, state, local code requirements, and as recommended by the manufacturer. The propeller fan installation shall be sufficiently rigid to prevent vibration and noise.

- e. Testing. -- Upon complete installation the fan shall be tested with the evaporative cooling units for a minimum of 8 hours to insure proper operation.
- f. Cost. -- The cost of furnishing and installing the propeller fans shall be included in the lump-sum price offered in the schedule for furnishing and erecting the pre-engineered metal building.

#### SECTION 6.5 - PACKAGED AIR-CONDITIONING UNIT

- a. General. - The air-conditioning shall be a factory assembled, packaged, air-to-air type complete with housing, direct-expansion evaporator coil, compressor, air-cooled condenser, automatic defrost system, economizer, drain pan, filters, drive motor, controls, and all accessories required for installation and operation. The air-conditioning unit shall be factory charged with HCFC 22 refrigerant. The air-conditioning unit shall be suitable for slab or platform mounting.
- b. Submittals. - Submittals shall be in accordance with this paragraph and 1.1.4 (Submittal Requirements). The following shall be submitted:
  - (1) Approval drawings and data. - Manufacturer's published commercial products data including; application data; performance tables or curves showing: sensible and total cooling capacities, electric resistance heating capacity, airflow, and static pressure; applicable performance correction factors for temperature, altitude and voltage; construction materials; and electrical characteristics. Calculations showing expected cooling performance corrected for design temperatures. conditions.
  - (2) Final Material. - Service manuals including installation, operation and maintenance instructions, and copies of all previously approved data.
- c. Materials. -
  - (1) Rating. - The air-conditioning shall be designed in accordance with UL Standard 559 and ANSI/ASHRAE 15 shall be rated in accordance with ARI 210/240, and ARI 270. The air-conditioning shall have an minimum rated a sensible cooling capacity of 32,000 Btu/h while supplying 1330 ft<sup>3</sup>/min. air flow, free discharge, with air entering the evaporator at 78 °Fdb/58 °Fwb, and outside air entering the condenser at 108 °F.
  - (2) Housings. - Components of the air-conditioning shall be contained and supported within a baked enamel finish metal housing. The housing shall be constructed of galvanized steel and shall be insulated in the inside. All components on the inside shall be easily accessible through side access panels. Housing shall be suitable for horizontal air discharge and return.
  - (3) Compressor. - The compressor shall be the fully hermetic type with crankcase heater. The compressor shall be mounted on suitable vibration isolators.

(4) Filter. - The filters shall be 2-inch fiberglass disposable type. Face velocity shall not exceed 300 ft/min at the rated air flow. If disposable filters are used, two spare filters shall be provided with the unit.

(5) Coils. - The evaporator and condenser coils shall consist of aluminum fins metallicity and/or mechanically bonded to copper tubing. Each coil shall include properly selected distributing heads. Each coil shall be rated for not less than 250 lbs./in.<sup>2</sup> working pressure and sized for not more than 500 ft./min. air velocity.

(6) Drain pans. - Drain pans shall be constructed from corrosion-resistant materials and shall include drain connections for attachment to the condensate drains.

(7) Economizer. - Economizer shall be the modulating type furnished with low leakage control dampers, and damper operators.

(8) Fans and drives. - Evaporator and condenser fans shall be the forward curved, centrifugal, belt or direct-drive type.

(10) Motors. - Each motor shall be the across-the-line, full-voltage-starting, constant-speed-induction type suitable for continuous operation. The motors shall be suitable for operating on 460 volt, 3 phase, 60 hertz power supply.

The horsepower nameplate rating shall be not less than 115 percent of the brake horsepower required at the tabulated performance.

Based on an ambient temperature of 40°C, the temperature rise rating for the type of motor enclosure and insulation class shall not exceed the temperature rise listed in the latest NEMA Standards for Test and Performance of Motors.

(11) Refrigerant accessories. - Each refrigerant circuit shall be furnished with filter dryer, service valves, sight glass, gauge ports, reversing valve, solenoid valve, and expansion valve.

(12) Controls. - The air-conditioning controls shall include room mounted electronic programmable thermostat, automatic short cycling protection, high pressure switch and low pressure switch, a compressor lock to prevent restart until reset at the thermostat, and solid state enthalpy based economizer controls.

d. Installation. - The air-conditioning and connecting ductwork shall be assembled, aligned, leveled, and fastened in place as shown on the drawings. Installation shall be in accordance with the equipment manufacturer's instructions, Uniform Mechanical Code (UMC), National Electric Code (NEC), and local codes and standards.

e. Cost. -- The cost of furnishing and installing the packaged air-conditioning unit shall be included in the lump-sum price offered in the schedule for furnishing and erecting the pre-engineered metal building

## DIVISION 7--MASONRY

## SECTION 7.1 - CONCRETE MASONRY

## 7.1.1. CONCRETE UNIT MASONRY

- a. General. -- The Contractor shall construct concrete unit masonry divider wall for the pre-engineered metal building.
- b. Product delivery and storage. - Materials shall be stored off the ground and under cover to prevent contact with moisture.
- c. Materials. -
  - (1) Regular masonry units. -
    - (a) Type. - ASTM C 90, type I, lightweight, hollow and solid units.
    - (b) Finish. - Standard Practice.
    - (c) Nominal size. - 8 inches by 8 inches by 16 inches.
  - (2) Mortar and grout materials. -
    - (a) Water. - Clean water free of objectionable amounts of silt, organic matter, alkali, salts, and other impurities.
    - (b) Portland cement. - ASTM C 150; type I, II, or III; standard gray color.
    - (c) Hydrated lime. - ASTM C 207, type S.
    - (d) Mortar aggregate. - ASTM C 144.
    - (e) Grout aggregate. - ASTM C 404.
  - (3) Reinforcing bars. - ASTM A 615, grade 60, uncoated deformed steel bar.
- d. Mixes. -
  - (1) Mortar. - ASTM C 270, type N proportion specifications using specified materials. Calcium chloride or anti-freeze compounds shall not be added to the mix. Mortar may be retempered in accordance with ASTM C 270 except mortar shall be used and placed in final position within 1-1/2 hours after mixing.
  - (2) Coarse grout. - ASTM C 476, proportion specifications using specified materials.

e. Preparation. -

- (1) Substrate preparation. - Concrete substrate surfaces to be in contact with mortar or grout shall be cleaned and roughened. Curing compound, laitance, efflorescence, loose or defective concrete, sand, dirt, and foreign material shall be removed.
- (2) Surface preparation. -- Before resuming work, the top surface of masonry in place shall be cleaned of loose mortar and foreign material.
- (3) Masonry unit preparation. - Masonry units shall be dry when laid and shall not be prewetted.
- (4) Reinforcement and accessories preparation. - Loose rust shall be cleaned from reinforcing bars, joint reinforcement, and other metal accessories before placement.

f. Installation. -

- (1) Coursing. -- Masonry shall be placed plumb, level, and true to required lines. Masonry courses shall be maintained to uniform width. Vertical and horizontal joints shall be equal and uniform in thickness.

Units shall be laid in running bond except as shown on drawings. One block unit and one mortar joint shall equal nominal block dimension.

- (2) Placing and bonding. -- Masonry shall be laid with completely filled mortar joints. Buttering corners of joints and deep or excessive furrowing of mortar joints are not permitted.

Units shall not be shifted or tapped after mortar has taken initial set. Units shall be removed and replaced with fresh mortar where adjustment must be made.

Concrete foundation surfaces to be in contact with grout shall be kept free of mortar. Cells and cavities to be grouted shall be kept free of mortar. Excess mortar shall be removed.

Units shall be saw cut to form straight unchipped edges where jobsite cutting is required. Units shall be cut dry.

- (3) Tolerances. -

- (a) Variation from unit to adjacent unit: 1/32 inch maximum.
- (b) Variation from plane of wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.

(c) Variation from level coursing: 1/8 inch in 3 feet, 1/4 inch in 10 feet, 1/2 inch maximum.

(d) Variation of joint thickness: 1/8 inch in 3 feet.

(e) Maximum variation from cross sectional thickness of walls: Plus or minus 1/4 inch.

(4) Reinforcement installation. - Reinforcing bars shall be supported and secured against displacement. Bars shall be maintained in position within 1/2 inch of true dimension. Bars shall be lapped a minimum of 40 bar diameters at bar splices.

(5) Grouting. - Grout fill shall be placed and consolidated without disturbing reinforcing. Thickness of grout shall be 1/2 inch, minimum, between reinforcing bars and masonry units.

Grout shall be placed in lifts of 4 feet, maximum, as wall is built. Grouting shall be stopped 1-1/2 inches below top of masonry when grouting is stopped for 1 hour or more. Grout shall be agitated to consolidate grout and fill space.

g. Pointing and cleaning. - Defective mortar shall be cut out and repointed with mortar to match adjacent work.

Excess mortar and mortar and grout smears shall be removed from masonry. Soiled surfaces shall be cleaned. Cleaning shall be in accordance with manufacturer's instructions. Cleaning methods shall not mottle, discolor, stain, damage, or acid burn masonry. Approval for each cleaning method shall be obtained from the Contracting Officer's Representative at the jobsite before using the method on the work.

h. Protection. - At workday's end, unfinished work shall be covered with secure waterproof covers to prevent moisture infiltration. Unfinished work shall be kept covered during work shutdown.

i. Cost. --The cost for furnishing and installing the CMU wall, including all labor and materials, shall be included in the lump sum price offered in the schedule for furnishing and erecting the pre-engineered metal building.

## DIVISION 8 PAINTING

## SECTION 8.1 - PAINTING

## 8.1.1. PAINTING, GENERAL

a. General.--The Contractor shall furnish all materials; clean surfaces; and apply the paint and protective coatings in accordance with this paragraph and Paragraphs 8.1.2. (Painting Tabulation) and 8.1.3. (Color Schedule for Painting).

Items or surfaces not required to be painted or coated but which are adjacent to surfaces to be cleaned and painted shall be protected against contamination and damage during the cleaning and painting operations. This includes surfaces and equipment which are subject to contact by airborne contaminants as well as those which are in physical contact with the areas being cleaned or painted. Examples include: mechanical and electrical equipment (open or enclosed), instruction and similar plates, and wet and newly painted surfaces. Newly painted items shall not be moved until the paint is completely dry. A paint film shall be considered dry through when it cannot be distorted or removed by exerting moderate pressure with the thumb and turning the thumb through 90° in the plane of the paint film.

The Contractor shall provide adequate ventilation, lighting, and the necessary safety equipment for the protection of the workers during painting and coating operations. See Bureau of Reclamation's publication "Reclamation Safety and Health Standards."

b. Materials.--All pigmented paints and primer shall be purchased in containers not larger than 5 gallons as packaged by the manufacturer unless the Contractor is equipped at the painting site to handle and thoroughly mix paints which are delivered in larger containers. Containers shall be labeled with the material specification number and the batch number. Color of finish paints shall be in accordance with Paragraph 8.1.3. (Color Schedule for Painting). All colors and tints shall be prepared by the manufacturer. Tinting at the jobsite shall not be done.

The Contractor may propose to substitute similar commercial paint having the same resin base and general composition as the paint specified herein, subject to the approval of the Government.

- (1) Primer coating, alkyd, corrosion-inhibiting, lead- and chromate free.--Federal Specification TT-P-664D.
- (2) Silicone-alkyd enamel, semigloss.--Federal Specification TT-E-490E.
- (3) Acrylic-emulsion exterior latex.--Federal Specification TT-P-9D.
- (4) Thinners and solvents.--All thinners and solvents shall be industrial grade. Selection of type shall be consistent with prevailing pollution regulations and paint manufacturer's recommendations unless otherwise specified.

c. Preparation of surfaces.--

(1) Metalwork.--Surface preparation shall be in accordance with the methods specified herein and as indicated in the painting tabulation. Any coatings not required by and not shown in the painting tabulation shall be removed from the surfaces by suitable and effective means, unless otherwise directed. All surfaces not specifically covered herein shall be prepared by methods common to good practice for the particular surface. If rust forms or the surfaces become otherwise contaminated in the interval between cleaning and painting, or between coats of paint, recleaning shall be performed by the Contractor.

(a) Initial surface preparation.--Any contaminants to the paint coating, from cleaning operations or other sources, shall be removed before the surfaces are painted.

All oil and grease, if present, shall be removed from steel surfaces to be painted by the use of clean solvent and clean, lint-free wiping material. Cleaning solvent shall be mineral spirits or xylene. Cleaning solvents shall be used in accordance with the manufacturer's Material Safety Data Sheet. Cleaning cloths and solvents shall be discarded before they become contaminated to the extent that a greasy film would remain on the surface being cleaned.

(b) Specific surface preparation.--Following initial surface preparation, specific surface preparation shall be by one of the following methods, as specified for each item in the painting tabulation.

Method A.--Dirt, scum and any other contamination shall be removed by solvent cleaning, water washing, or other effective means. The solvent chosen should be one which does not leave a residue. Xylene, for example, does not leave a residue, but mineral spirits does. Surfaces with gloss or semigloss paints shall also be sanded lightly.

Method B.--Following the initial surface preparation and solvent cleaning, the surfaces shall be cleaned of all defective or damaged areas of existing paint, and of all loose rust, loose mill scale, and other foreign substances by scraping, chipping, wire brushing, gritblasting, commercial grade sandblasting, or other effective means. Commercial grade sandblasting shall be performed in accordance with standard practices.

Method U (gypsum board).--Cracks and other surface imperfections in gypsum board shall be finished with joint compound in accordance with Section 4.2 for finishing joints. Prior to painting, all surfaces shall be brushed, or wiped with clean, lint-free wiping material, to remove dust and other foreign material.

d. Application.--

(1) General.--Materials shall be thoroughly mixed at the time of application. Surfaces shall be clean and, unless otherwise specified, free from moisture at the time of application.

Care shall be exercised during spray application to hold the nozzle sufficiently close to the surface being painted to produce a continuous wet coat, and to avoid excessive evaporation of the volatile constituents and loss of material into the air, or bridging over crevices and corners. Effective means shall be provided for removing free oil and moisture from the air-supply lines of all spraying equipment. Spray equipment shall be equipped with mechanical agitators, pressure gages, and pressure regulators. Nozzle pressure consistent with acceptable finish results shall be employed when spray painting.

Each coat shall be applied in such a manner as to produce an even film of uniform thickness which will completely cover irregularities, fill crevices, and be tightly bonded to the substrate or previous coat. Each coat shall be free from runs, pinholes, sags, laps, brush marks, voids, and other defects.

Each coat shall be allowed to dry or to harden before the succeeding coat is applied.

Thinning of paints to facilitate satisfactory application shall be kept to a minimum but in no event shall it exceed 1 pint per gallon of paint, except as otherwise specified; only thinner approved for the type of paint shall be used.

All Contractor-applied coatings exposed to public view shall present a uniform texture and color-matched appearance.

Methods of preparing and applying paints and coatings not included in these specifications shall be in accordance with the manufacturer's instructions and the general requirements of these specifications.

(2) Application of specific materials shall be as follows:

(a) Priming paints.--Lead- and chromate-free anticorrosive primer shall be applied at a maximum coverage of 450-square-feet per-gallon per coat, but the dry-film thickness shall not be less than 1.0 mil for the first coat. Following the first coat of priming paint, an additional "edge" coat shall be applied over all rivets, welds, bolts, seams, sharp corners, and edges before subsequent painting. The first coat shall be applied by brush or roller and subsequent coats shall be applied by either brush, roller, or spray.

(b) Enamels.--For ferrous surfaces, enamels shall be spray applied to produce a minimum dry-film thickness of 1.5 mils per coat, and the total minimum dry-film thickness of the coating system shall be 4.0 mils.

For nonferrous surfaces, spray apply at a maximum coverage rate of 500-square-feet-per-gallon per coat.

(c) Acrylic Emulsion.--Apply in accordance with manufacturer's instructions at a maximum coverage rate of 400-square-feet-gallon per coat to produce a minimum dry-film thickness of 1.5 mils per coat.

f. Submittals.--Submittals shall be in accordance with this paragraph and paragraph 1.4.3. (Submittal Requirements).

(1) Color samples.--The contractor shall submit to the Government, for selection of paint color, two sets of color samples.

g. Cost.--The cost of furnishing, preparing, and applying all materials for the cleaning, paint repairing, and painting or coating operations shall be included in the applicable prices offered in the schedule for installing the pulse filter system.

#### 8.1.2. PAINTING TABULATION

a. Painting tabulation.--

No.	Item	Surface preparation method	Paint or coating material	Number of coats
1	Bag house	B	Prime coat: Alkyd, corrosion-inhibiting, lead- and chromate-free  Finish coat: Silicon alkyd enamel	1  2 1.4-mil DFT, min./coat 4-mil DFT, min./coat
2	Bollards	B	Prime coat: Alkyd, corrosion-inhibiting, lead- and chromate-free  Finish coat: Silicon alkyd enamel	1  2 1.4-mil DFT, min./coat 4-mil DFT, min./coat

No.	Item	Surface preparation method	Paint or coating material	Number of coats
3	Fans, motor and duct work	A	Finish Coat: Silicon alkyd enamel	2 1.4-mil DFT, min./coat 4-mil DFT, min./coat
4	Gyp. board wall (both sides)	U	Acrylic-emulsion latex	2 1.5-mil DFT, min./coat 3-mil DFT, min./coat
5	Trans-formers, switches, and panel boards	B	Prime coat: Alkyd, corrosion-inhibiting, lead- and chromate-free  Finish coat: Silicon alkyd enamel	1  2 1.4-mil DFT, min./coat 4-mil DFT, min./coat

### 8.1.3. COLOR SCHEDULE FOR PAINTING

The Government shall choose the paint color for the filter system, and gyp. board wall based on samples provided by the contractor which match the trim color of the pre-engineered metal building.

The color for the bollards shall be "Safety Yellow".

The color for the transformers, disconnect switches, and panel boards shall be grey.

## DIVISION 9--DRAWINGS

### SECTION 9.1 - DRAWINGS

#### 9.1.1. DRAWINGS, GENERAL

a. General.--In the event there are minor differences as determined by the Contracting Officer between details and dimensions shown on the drawings and those of existing features at the site, the details and dimensions of existing features at the site shall govern.

The Contractor shall check all drawings carefully and advise the Contracting Officer of any errors or omissions discovered.

b. Additional or revised drawings.--Except as otherwise provided in these specifications for drawings to be furnished by the Contractor, the specifications drawings will be supplemented by such additional or revised general and detail drawings as may be necessary or desirable as the work progresses; and the Contractor shall do no work without proper drawings and instructions. The Contractor will be required to perform the work in accordance with the additional general and detail drawings or revisions furnished by the Government at the applicable prices offered in the schedule for such work.

c. Additional copies of drawings.--The Contractor will be furnished such additional copies of the specifications and drawings as may be required for performance of the work. Full-size contact prints of the original drawings from which the attached reproductions were made will be furnished to the Contractor for construction purposes upon request. The number of prints of each drawing furnished to the Contractor will be limited to 5 contact prints and 1 reproducible.

d. Mailing address.--All drawings and data submitted by the Contractor for which a specific mailing address is not given in these specifications shall be submitted to the Construction Engineer, Attention: LCD-2000, Bureau of Reclamation, P.O. Box 60400, Boulder City, Nevada 89006-0400.

## 9.1.2. LIST OF DRAWINGS

The following drawings are made a part of these specifications:

PRE-ENGINEERED CARPENTRY/SANDBLAST SHOP  
BOULDER CANYON PROJECT  
HOOVER DAM  
NEVADA

LIST OF DRAWINGS

Sheet No.	Drawing No.	Drawing Title
1	45-301-6725	Hoover Dam, Location Map
2	45-301-6574	Hoover Dam Warehouse Complex Carpentry/Sandblast Shop Site Plan
3	45-301-6575	Hoover Dam Warehouse Complex Carpentry/Sandblast Shop Plans - Sections - Details
4	45-301-6576	Hoover Dam Warehouse Complex Carpentry/Sandblast Shop Mechanical Plan
5	45-301-6577	Hoover Dam Warehouse Complex Carpentry/Sandblast Shop Lighting and Grounding Plans
6	45-301-6578	Hoover Dam Warehouse Complex Carpentry/Sandblast Shop Electrical Schematics and Diagrams
7	45-301-6579	Hoover Dam Warehouse Complex Carpentry/Sandblast Shop Conduit Plans
8	45-301-5216	Hoover Power Plant Electrical Installation 2300 V. Power Distribution System
9	45-D-8381	Boulder Switchyard - Concrete Structure City of Los Angeles General Layout and Key Plan

Sheet No.	Drawing No.	Drawing Title
10	45-D-8417	Boulder Switchyard - Concrete Structure City of Los Angeles Relay House Equipment Arrangement - Conduit Installation
11	45-D-8494	Hoover Switchyard - Electrical Installation City of Los Angeles Relay House Section Showing Conduit Installation in Basement
12	45-D-10135	Hoover Switchyard - Electrical Installation 2300 volt Wiring Diagram
13	40-D-6263	General Notes and Minimum Requirements for Detailing Reinforcement
14	40-D-4334	Electrical Installation Typical Grounding Details
15	40-D-4335	Electrical Installation Typical Grounding Details
16	40-D-5370	Buried Insulated Cables Typical Details
17	40-D-4753	Electrical Installation Grounding Details
18	40-D-2567	Standard Nameplates
19	001	As built of Underground Facility
20	002	As built of Underground Facility
21	Details of 001	As built of Underground Facility
22	Details of 002	As built of Underground Facility